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MODERATE SPECTRAL ATMOSPHERIC RADIANCE AND TRANSMITTANCE CODE (MOSART).

Volume II: User's Reference Manual

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7 November 1995

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The Moderate Spectral Atmospheric Radiance and Transfer (MOSART) computer program calculates atmospheric transmission and radiation in the ultraviolet region through the microwave spectral regions (0.2 μm to infinity or 0 - 50,000 cm^{-1}. The spectral resolution is variable from a value of 2 cm^{-1} upward in increments of 1 cm^{-1}. It contains features which have been extracted from the MODTRAN code developed by the Geophysics Division (PL/GPOS) of the Air Force Phillips Laboratory and the APART code developed by Photon Research Associates (PRA). Because of the requirement that MOSART be compatible with various codes used in the SSGM (Strategic Scene Generation Model), the overall structure of this version of MOSART closely follows that of APART. However, MOSART contains all the MODTRAN atmospheric features and is easily used for that code's usual point-to-point calculations.

This volume provides the user with information describing the installation of MOSART. The other volumes describe running the code (Vol. II), technical discussion (Vol. III), and the structure of MOSART (Vol. IV). To provide users with on-line assistance, this volume is available in a series of "html" files that can be viewed using the MOSART Input Builder or the MOSAIC Software.

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1.0 INTRODUCTION

The Moderate Spectral Atmospheric Radiance and Transfer (MOSART) computer program calculates atmospheric transmission and radiation in the ultraviolet through the microwave spectral regions (0.2 μm to infinity or 0 - 50,000 cm^{-1}). The spectral resolution is variable from a value of 2 cm^{-1} upward in increments of 1 cm^{-1}. It contains features extracted from the MODTRAN code developed by the Geophysics Division (PL/GPOS) of the Air Force Phillips Laboratory and the APART code developed by Photon Research Associates (PRA). MODTRAN is widely used in many different atmospheric studies, both within and without the DoD. Since APART was developed to provide atmospheric calculations for infrared (IR) signature studies of both targets and backgrounds, it has many features that are desirable for large simulation models. Because of the requirement that MOSART be compatible with various codes used in the SSGM (Strategic Scene Generation Model), the overall structure of this version of MOSART closely follows that of APART. However, MOSART contains all the MODTRAN atmospheric features and is easily used for that code's usual point-to-point calculations.

This volume of the Users Manual provides the user with the information required for running the code. The other volumes in the Users Manual describe installation of MOSART (Vol. I), technical discussion (Vol. III), and the structure of MOSART (Vol. IV). To provide users with on-line assistance, this volume of the Users Manual is available in a series of ".html" files that can be viewed using the MOSART Input Builder or the Mosaic Software.

MOSART and its utility programs are written in ANSI X3.9-1978 FORTRAN (FORTRAN 77) and are highly portable. The source code delivered with MOSART includes:

FPTEST:	Tests machine dependent operations
INSTDB:	Installs direct access binary data bases
MOSART:	Is the main MOSART program
ASCBIN:	Converts binary files to ASCII and vice-versa
BBTEMP:	Converts radiance to equivalent blackbody temperatures
CRFILE:	Assists in preparing the MOSART input file
FACET:	Calculates emitted and reflected radiance from a surface
MRFLTR:	Degrades the spectral output using a filter function
PLTGEN:	Makes graphs of the results
SCNGEN:	Creates statistical scenes
TERTEM:	Calculates diurnal terrain material temperatures
VISUAL:	Converts visible radiances to luminances and determines color

2.0 MOSART EXECUTION INSTRUCTIONS

The MOSART program is normally run in a mode for the standard calculation of parameters. However, if the job has been terminated abnormally, under certain conditions it can be restarted. This section will discuss both methods of running the MOSART program.

2.1 Standard Program Usage

The actual commands required to submit and execute a MOSART job will depend upon your computer. The examples provided below are for a Silicon Graphics system operating under UNIX.

A single prompt (discussed below) and all warning and error messages are provided to the device designated by "*". Normally, this device is defined as the terminal, but for background (or batch) jobs, or in case of redirected output, this device is defined in terms of the batch or redirection command. A sample command file, or shell script, for executing the MOSART program in a UNIX environment is given by:

```
#
mosart.exe << EOF >> $argv[1].stream
$argv[1]
EOF
#
```

In this example, all input is received between the start of execution of the MOSART program ("mosart.exe ...") and the end-of-file ("EOF") statement. All output to "*" is directed to the file ****.stream, where "*****" is a user-supplied argument (denoted by $argv[1] above).

If one executes the mosart program from a terminal (not recommended for most jobs), the run stream looks like

<u>mosart.exe</u>

File root name: <u>Sample</u>

or

mosart.exe

File root name:
Sample

depending upon the type of FORMAT statement used in PROMPT (see Installation Reference Manual). The convention is that all underlined text is provided by the user.

Due to the large amount of CPU time required for most calculations, it is recommended that most MOSART jobs be performed in the background (or batch) mode, as opposed to the interactive mode. For a UNIX system, the command to execute the command file shown above is:

mosart.com Sample &,

where "mosart.com" is the executable command file and "Sample" is the desired file root. The character "&" is used to place the job in the background.

The file root provided is used in conjunction with the suffixes, either as provided with the program or as modified at installation time (see Installation Reference Manual). If the suffixes were modified at installation, you might want to make the appropriate changes to the manual below. There are seventeen (17) files that are defined by the file root provided by the user at execution time and the suffixes. For example, as delivered, the input file is defined to be:

filert.in

where "filert" is the user-supplied file root and ".in" is the suffix appended to the file root by the MOSART program and its utility programs. As delivered, the suffixes are in lower case and are defined as follows:

Input file	-	".in"
ASCII summary output file	-	".out"
Atmosphere binary output file	-	".atm"
Background binary output file	-	".bck"
Plume binary output file	-	".plm"
Multiple scattering binary output file	-	".msc"
Heat transfer binary output file	-	".htr"
Transmittance binary output file	-	".trn"
TAPE7 ASCII output file	-	".tp7"

TAPE8 ASCII output file	-	".tp8"
User-defined atmosphere input file	-	".uat"
User-defined background input file	-	".ubk"
User-defined hydrometeor input file	-	".ucl"
User-defined aerosol input file	-	".uar"
ASCII conversion data file	-	".asc"
User-defined spectral filter file	-	".flt"
ASCII spectral tabular file	-	".tbl"

For standard processing, the assumption is made that the only existing file is the input file. If the ASCII summary output file exists, it will be deleted. If any of the binary output files exist (i.e., the atmosphere, background, plume, multiple scattering, heat transfer, or transmittance files), they are checked to see if they have been completed. If they have been completed, the job is terminated. If these files are incomplete, the MOSART program will restart and complete the existing files (see Section 2.2).

During execution, MOSART outputs to the device designated by "*" the geometry summary as follows:

```
M       M    OOOOO      SSSSS       A      RRRRRRR   TTTTTTTTT
MM     MM  O      O   S      S     A A     R      R      T
M M   M M O        O S        S   A   A    R       R     T
M  M M  M O        O S          A       A  R       R     T
M   M   M O        O  S        A        A  R      R      T
M       M O        O   SSSSS   AAAAAAAAA  RRRRRRR        T
M       M O        O        S  A        A  R   R         T
M       M O        O         S A        A  R    R        T
M       M O        O S       S A        A  R     R       T
M       M  O      O   S     S  A        A  R      R      T
M       M   OOOOO      SSSSS   A        A  R       R     T

                       (Version 1.25)
                       (30 June 1994)


 File root name:

     1:  User-specified Parameters -----------------------
     2:  Position Parameters -----------------------------
     3:  Geometry Parameters -----------------------------
     4:  Spectral Parameters -----------------------------
     5:  .

 Warning No. 21:  Source altitude less than terrain altitude.
                  Source altitude no.    4 set to      0.243 km.
```

```
 Sample Input File
 MOSART Radiative Environment Summary (Ver. 1.25) Thu Aug 18 11:08:56 1994
Scratch file number    29 OPENed.  Type:  Geometry Parameters


 Geometry Conditions (12 positions)

           Observer     Src/Tang         Slant  Earth Center  Obs. Look   Src. Look
 No        Altitude     Altitude         Range       Angle       Angle       Angle
              (km)         (km)           (km)        (deg)       (deg)       (deg)

  1  Se     100.00         1.00        1049.99        9.35      -10.01        1.00
  2  Be     100.00                       99.77        0.00      -90.00
  3  Ce     100.00         1.00          99.01        0.00      -90.00       90.00
  4  Ce     100.00        88.56         120.00        1.06       -6.00        4.94
  5  Cz     100.00         1.00          99.01        0.00      180.00        0.00
  6  Cl     100.00         1.00         477.71        4.18      -14.03        9.93
                                                           Lat:  46.00 Lon: -98.20
  7  Ae       1.00
  8  He       1.00                        1.00        0.01
  9  Le     400.00       349.57                                   -7.00
 10  Le     100.00         1.00                                   -9.96
 11  Le     400.00      -200.00                                  -24.28
 12  Le     400.00         0.38                                  -19.75

STOP Normal Termination statement executed

18.3u 2.6s 0:30 68% 0+0k 100+13io 54pf+0w
```

The title of each input file section is echoed to the screen, along with any warning messages (see Section 7.3.1), the header and title, and a summary of the geometry parameters.

The notation about the scratch file is informational only. When the calculations are complete, the MOSART program will then output:

STOP: Normal termination

This final message is somewhat computer system-dependent, as the message "Normal termination" is output using the STOP statement.

2.2 Restarting Procedures

The MOSART program can restart a calculation if the job has been terminated for external reasons (e.g., the computer "crashing", running out of disk space). However, if the job terminates due to an internal error, you should not attempt to restart the calculations.

To restart a job, you must have saved one of the binary data files (preferably the ".atm" or ".bck" files). If this is the case, do not delete any files that have been

created during the job; simply submit the job again. MOSART will check to see if the binary files exist. If they do, MOSART will check to see if the files are complete. If the job has terminated prematurely, the binary files should be incomplete. In this case, MOSART will restart the calculations at the point the job was terminated.

If the binary files are complete, the job did not terminate prematurely, and no action is taken. If no binary data files are being saved, MOSART will start the job at the beginning. Under some conditions and on some computers, the last record in an incomplete binary data file may not be complete. This may be due to the job terminating during a WRITE, or if the computer I/O stores the parameters in a buffer, it may not have properly flushed the buffer before termination. If this occurs, the restart will not occur, since the program will terminate with a READ error (rather than end-of-file) message. One must then delete all binary data files and start the job over from the beginning.

3.0 INPUT FILE FORMAT

All MOSART input files consist of a descriptor field and a user-supplied input field. The format of the input file can be a combination of linear input fields and tabular input fields, as described below.

The linear input field consists of a descriptor field in columns 1 through 40, inclusive, while the input field is normally in columns 41 through 80, inclusive. All alphanumeric strings in the input field are expected to be in free format. All input parameters may begin in any column between 41 and 80, inclusive; all leading blanks will be removed from any alphanumeric input by the program. If columns 41 through 80 are blank, CHARACTER data becomes blank (or "No" for a Yes or No response) and numeric data is set to a default value (i.e., -9999.0 for REAL and -9999 for INTEGER). If there is an error in the input (e.g., CHARACTER input when numeric input is expected), the numeric value defaults to -9999. For those input fields where multiple entries are expected (e.g., observer azimuth angles), the MOSART program will determine that number provided; if none are provided, one default value (see above) is assumed. For variables where a default value of -9999 is not reasonable, the code will replace the -9999 value by the default value listed in this manual.

If the input field will not fit in columns 41 through 80, up to a maximum of 255 characters in additional lines can be used by appending the character "&" at the end of the line. For example:

```
User-defined elevation angles (deg) .. 90. 70. 50. 30. &
          0  -30.   -50.   -70.   &
         -90.
```

The count of 255 characters includes the first non-blank character in the first line (past column 40) to the last non-blank character in the last line; the "&" is executed from the count.

For a tabular input field, such as the geometry definition in the MOSART input file (see below), the geometries are best input as a series of records, each record containing all the parameters for that geometry. The tabular field will usually have several records of descriptor headings to describe each element in the table and provide appropriate units. The tabular data is terminated by an alphanumeric string whose first three (3) non-blank characters must be "End" (usually "End of Data") and a slash to terminate the free-format, or list directed, READ. All character input to MOSART is case insensitive, so "end", "End", or "END" are acceptable.

It should be noted that it is not necessary to specify the number of elements in a linear or tabular input field. The MOSART program automatically parses the information presented and determines the number of entries. For tabular inputs a number is frequently included (e.g., the geometry specification) but is not used within the code; it is provided solely for the convenience of the user.

Certain input files are modular in that they consist of certain sections that can be included (or not) as desired. For these modular input files, the section title must exactly match the title stored within a BLOCK DATA module in the program. The order of sections in a particular input file is usually not important. The one exception to the order-independence of the input sections is that the section specifying the User-Defined File Names must be the first optional section. For all non-modular input files and for each section in a modular input file, all lines (including those consisting simply of a ".") are required in the order shown in this manual.

The convention for CHARACTER input is case insensitive. If only a single character input is required, the left-most CHARACTER is used. For example, for "Y", inputs of "Yes", "Yep", and "Yoooo" are equivalent. For those inputs where more than one character is required, the manual will define the minimal acceptable string. For some inputs, the input can either be numeric (e.g., "1") or alphabetic (e.g., "Rural").

4.0 MOSART INPUT FILE (xxxxxx.inp)

The main MOSART input file is modular in structure. It consists of a required section, followed by several sections that can be omitted or included as required. Each section has a set of related input parameters. Only five (5) sections are required for all runs; the remaining ones are optional, and their order within the input file is arbitrary except that the User-Defined File Names must be the first optional section. The end of each section consists of a line that consists only of a dot (".") in column one.

The sections are as follows:

Title
User-Specified Parameters
Position Parameters
Geometry Parameters
Spectral Parameters
User-Defined File Names
File Retention Specifications
Atmospheric Parameters
Solar and Lunar Parameters
Hydrometeor Parameters
Terrain Specifications
Observer Parameters
Extra Altitude Specifications
Source Earth/Skyshine Specifications
Antecedent Specifications
User-Defined Atmospheric Parameters
Terrain Material Temperatures

Due to the modular nature of the MOSART input file, an interactive utility program (i.e., CRFILE) is supplied with MOSART to assist in the creation of a file. Also, a MOSART Input Builder Graphical User Interface (GUI) Input Builder is available for systems with X-windows and MOTIF. Please refer to Section 6.1 of this manual for additional information.

If you would prefer to have the text in the input file in another language (e.g., French or German), you can modify the CHARACTER strings in BLOCK DATA INPTBD in both the MOSART and CRFILE programs.

Each of the sections is discussed below.

4.1 Required Input File Sections

Five (5) sections of the MOSART input file are required. Each is discussed below.

4.1.1 Title

The first required section consists only of a Title line and the requisite dot (".") to end the section:

```
Moderate Spectral Atmospheric Radiance and Transmittance (MOSART) (Ver. 1.00)
.
```

The remaining required sections are User-Specified Parameters, Position Parameters, Geometry Parameters, and Spectral Parameters. Each of these sections is discussed in detail below.

4.1.2 User-Specified Parameters

The User-specified Parameters section allows the user to control the output and execution of the program. The section looks like:

```
User-specified Parameters -----------------------------
 Header ...................................Sample
 Printout Switch (S/M/L) .................. S
 Terrain Temperature Calcul. (Y/N) ......... N
 Multiple Scattering Calcul. (Y/N) ......... N
 Solar/Lunar Ephemeris (Y/S/L/N) ........... N
 .
```

The Header is the first user-supplied input. It follows the section title (which must be exactly as in the BLOCK DATA INPTBD so that the program will recognize it); the header consists of 40 characters or less. This header, along with a title and date and time, appears on all output files. The user can use this header to identify the output.

The Printout Switch (S/M/L) can be set to short (S), medium (M), or long (L), depending upon the type and amount of output desired. Exactly what parts of the output file (i.e., xxxxxx.out) are printed with each option is discussed in the description of the output file (see Section 5.1).

The Terrain Temperature Calcul. (Y/N) allows the user to specify whether temperatures are calculated for the terrain materials; the inputs are Yes (Y) or No

(N, or any character that is not Y or y). If No is selected, then the temperatures can either be individually defined by the user (described below) or set to the ambient air temperature. If your application does not require a detailed modelling of the terrain, you may want to avoid the expense associated with these calculations.

The Multiple Scattering Calcul. (Y/N) determines whether atmospheric multiple scattering is calculated. Unlike MODTRAN, MOSART does not have a single scatter option. A Yes (Y) input is equivalent to running MODTRAN with the parameters IEMSCT = 2 and IMULT = 1.

The Solar/Lunar Ephemeris (Y/S/L/N) specifies the external sources. It is possible to select:

S: Sun Only
L: Moon Only
M: Moon Only
Y: Both Sun and Moon
N: Neither

This input is used instead of the Solar and Lunar Parameters section (see Section 4.2.4). If a "Y", "S", "L", or "M" response is provided here, the Solar and Lunar Parameters section should not be included. If it is included, it will be ignored.

Again, the dot (".") is used to terminate the section.

4.1.3 Position Parameters

The Position Parameters section provides the location of the scenario both spatially and temporally. The section looks like:

```
Position Parameters -----------------------------
 Coordinate Reference (Observer/Source) .... Source
 Latitude (deg) (+ North, - South) .........  45.
 Longitude (deg) (+ East, - West) .......... -100.
 Day of the month (integer) ...............    25
 Month of the year (integer) .............. June
 Year (integer) ........................... 1989
 Time of day (24-hr HH.MMSS) .............. 12.0000
 Time index (LST/GMT) ..................... LST
 .
```

The Coordinate Reference (O/S) specifies the origin of the coordinate system for defining the LOS path geometries. The default value of the coordinate reference is "S". The origin is located at sea level (0 km altitude) at the latitude and longitude of either the Observer (O) or the Source (S). If necessary, the latitude and longitude

of the other end of the LOS path can be defined explicitly in terms of latitude and longitude using the "I" specification in the Geometry Parameter section. For example, if Source is selected in the Position Parameters section, the latitude and longitude of this section specify the location of the source. If "I" is used as a geometry parameter specification, the latitude and longitude specified are those of the observer.

The Latitude and Longitude (in deg.) specify the terrestrial location of the origin of the MOSART coordinate system. As indicated in the input text, the latitude is defined between -90 degrees (South Pole) and +90 degrees (North Pole). The longitude is defined between -180 degrees (West) and +180 degrees (East); if other values are input, they will be transformed to fit this convention (e.g., an input of +270 degrees will be changed to -90 degrees).

Other optional inputs can be quite sensitive to the location, making the position of the coordinate system very important. For example, if no model atmosphere is selected, the latitude will be used to select the model atmosphere. Similarly, if no terrain scene model is selected, the latitude and longitude will determine the terrain scene type and altitude.

The Day of the month, Month of the year and Year specify the date of the calculation. All three inputs are integers except that the month can also be entered as a character variable. The month character input is case insensitive and requires the first three characters of the month name (e.g., Apr for April). If you wish to use the LOWTRAN specification of the date (i.e., the day of the year), simply put the day of the year in for the day of the month and set the month to January (i.e., "1" or "Jan" or "jan" or "JAN"). The program will transform the input to the desired date. For example, 65 Jan will be transformed to 6 Mar (or 5 Mar on leap years); similarly, 35 Jun will be transformed to 5 Jul.

The Time of day is based on a 24-hour clock. The input format is either HH.MMSSS or HH:MM:SS.S, where HH is the hour (0-23), MM is the minute (0-59), and SSS (or SS.S) is the decimal second. If more than three significant figures are desired for seconds (i.e., a more accurate specification than a tenth of a second), simply add the appropriate number of digits. For example, 4:03:08.356 p.m. would be input at 16:0308356 or as 16:03:08.356.

The Time index (LST/GMT) identifies the time of day as either Local Standard Time (LST) or Greenwich Mean Time (GMT). It is strongly recommended that GMT be used whenever possible, since MOSART internally converts LST to GMT by assuming a one hour shift for every 15 degrees of longitude from Greenwich Meridian. Since local time zones (and daylight savings time) are defined by politics

and geography, the use of LST can lead to unforeseen errors, particularly with respect to the ephemeris calculations. GMT is the default.

4.1.4 Geometry Parameters

The Geometry Parameters section defines the geometries for which the calculations are performed. The section uses a tabular input format as shown:

```
Geometry Parameters -----------------------------
Observer Azimuths (deg) (<=8) ......... 0.0 90.0 180.0 270.0
Azimuth Reference (Relative/True) ..... R
.
No. Index Obs. Alt. Src. Alt. Sl. Rng. Earth Ang. Obs.Angle Src.Angle Length
                (km)       (km)      (km)       (deg)      (deg)     (deg)   Switch
 1    C      0.0       11.0      ****         1.0        ****      ****      1
 2    Se   100.0        2.0      ****        ****       -88.0      ****      0
End of Geometry Data/
.
```

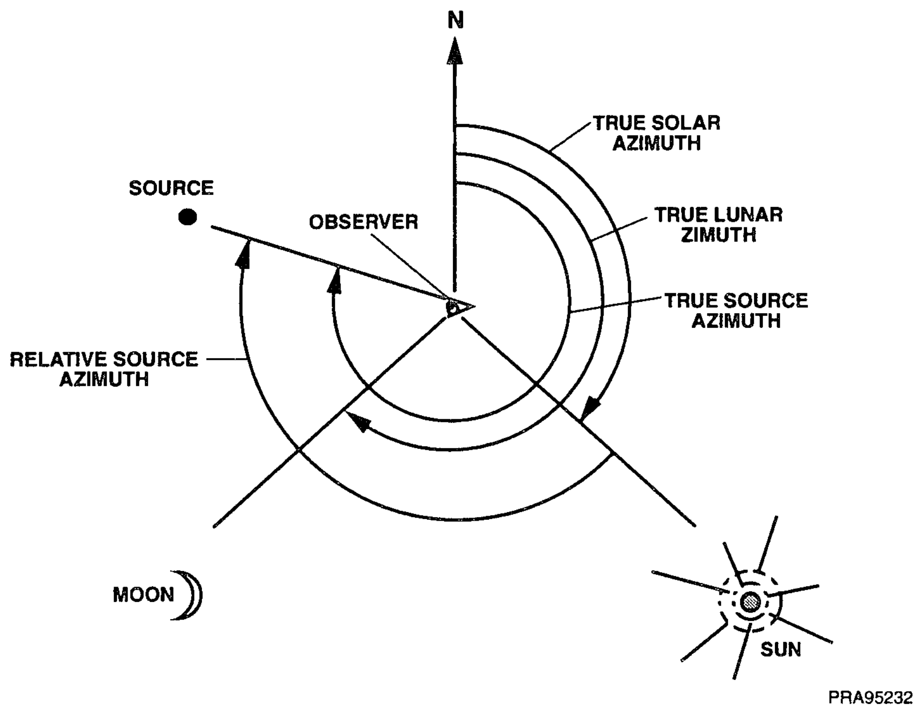
The Geometry Parameter section consists of:

- Section Title (1 line);
- Azimuth Definition (one or more continuation lines followed by two additional lines; last line is simply a ".");
- Tabular Labels and Units (2 lines);
- Geometry Parameters (up to a maximum of 15 lines);
- Table Termination (1 line); and
- Section Termination Dot (".") (1 line).

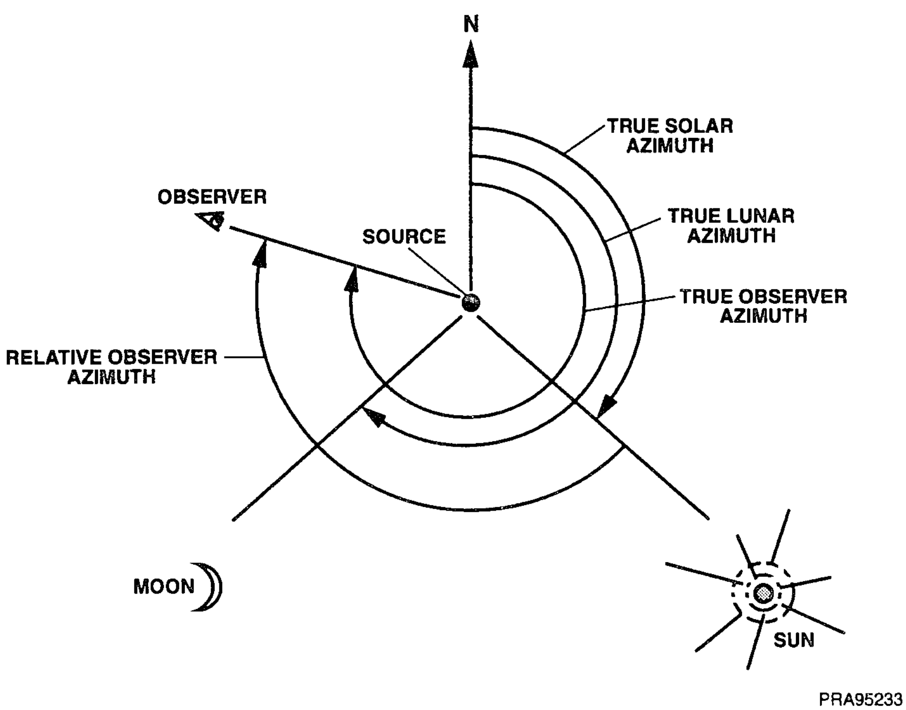
The user can input up to a maximum of thirty (30) Observer Azimuths. Depending upon the specification of the Azimuth Reference as either Relative (R) or True (T), the specified azimuths are defined either relative to the solar position (i.e., 0 degrees azimuth is toward the solar position) or relative to True North, respectively. In either case, the azimuth angles are assumed to be increasing in value in a clockwise direction. If the azimuth is defined with respect to true North (0 degrees), 90 degrees is East, 180 degrees is South, and 270 degrees is West, and 360 degrees is North again.

The definition of the observer azimuth depends on whether an observer or a source reference frame is selected. Refer to Figure 1 for definitions of azimuth angles for the two reference frames.

For solar scatter, there is relative azimuthal symmetry about the 0-180 degree line if a relative azimuth reference is specified, that is the solar scatter at 90 degrees



(a) Observer Coordinate Reference



(b) Source Coordinate Reference

Figure 1. Azimuth.

relative azimuth equals that of 270 degrees relative azimuth. However, for a true azimuth reference, the solar scattering will not be symmetric. Also, for global backgrounds, for either azimuth reference, the background may be different for each side of the 0-180 degree line, so asymmetries will result.

The Table Termination line must have either "End" or "end" in the first three (3) non-blank characters and the last character must be a "/". This informs the program that the end of the table has been reached. Remember that the input is case insensitive.

The first field in the geometry input table is a geometry number. It is not used by the program and is provided simply to assist the user.

The second field in the geometry input table is a pair of characters (referred to as the Leading and Trailing indices) indicating both the type of geometry and the type of calculation. The first character indicates the type of both path and calculation. The second character indicates the type of angles used in defining the geometry. Acceptable values for the various geometry parameters (see Figure 2) are shown in Table 1. These two characters will be discussed in greater detail shortly.

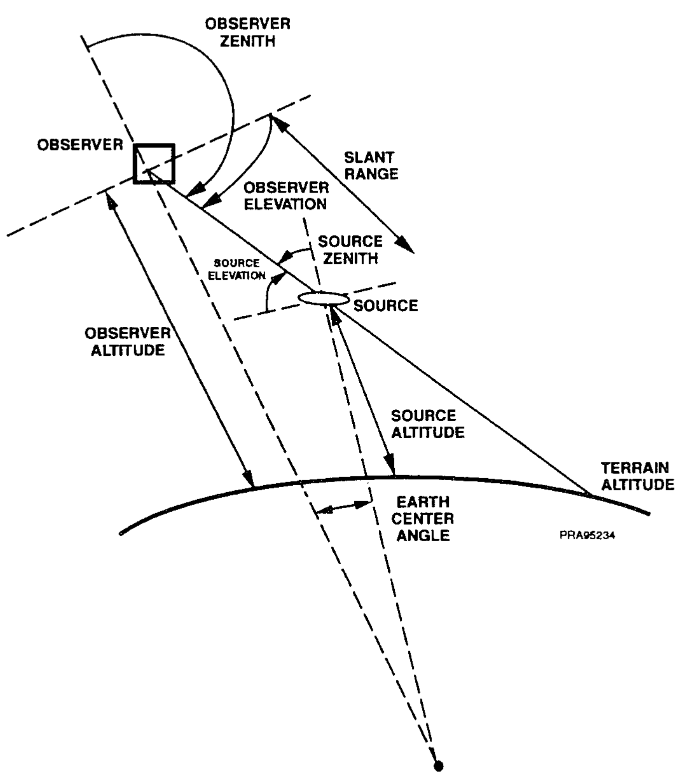


Figure 2. MOSART Geometry.

Table 1. Geometry Summary.

Parameter Definition	Observer Altitude (km)	Source or Tangent Altitude (km)	Slant Range (km)	Earth Center Angle (deg)	**	Observer Look Angle (deg)	Source Look Angle (deg)	Path Angle Switch
Range of Permissible Values	Non-Negative Number	Real Number > -6371 km ****	Non-Negative Number	Positive Number	z e l	0<zenith<180 -90<elevation<90 lat & long	0<zenith<180 -90<elevation<90 lat & long	0 or 1
Input Parameter Search Order	1	2	3	4		5	6	
Leading Index — Meaning								
A — At-source calculations	x							
S* — Source (only) calculations B* — Background (only) calculations (+) C* — Combined source and background (contrast) calculations	x	x	x					
	x	x		x				
	x	x					x	***
	x	x				x		***
	x		x			x		
	x			x		x		
	x	x			l	x	x	
L* — Earthlimb calculations	x	x						
	x					x		
	x				l	x	x	
H — Horizontal path calculations	x		x					
	x			x				

* Admissible Combinations for These Options

\+ Background (Only) Calculations Do Not Use the Source or Tangent Altitude

** Trailing Index Definition

z Observer and source look angles are zenith angles

e Observer and source look angles are elevation angles

l Observer and source look angles are latitude and longitude

*** The path length switch is required only when an ambiguity exists (see Figure 4-3)
A 0 (zero) value specifies a short path length
A 1 (one) value specifies a long path length

**** 6371 km is the radius of the earth

The search defaults for a given geometry specification are that the program searches the input parameters in the order:

1. Observer altitude (HOBS)
2. Source altitude (HSRC)
3. Slant range (SLRNG)
4. Earth center angle (BETA)
5. Observer look angle (PHIOBS)
6. Source look angle (PHISRC)

The search stops when it finds a set of parameters sufficient to characterize a path. All subsequent parameters are ignored. For the various geometries, acceptable combinations are shown in Table 1.

Since the MOSART program input files are all free format (i.e., list-directed format), each geometry record must contain nine (9) non-blank fields separated by either blanks or commas. Since only some of the fields will be used to specify the appropriate parameters, the other fields must contain either values outside the acceptable range (see above) or non-numeric values. It is recommended that all fields that are not used be expressed by "******". The program will recognize any non-numeric field as an invalid value and ignore it.

The parameter LEN is a path length switch. It is only required when the observer look angle is specified as negative, since for this geometry, a short (LEN = 0) and a long (LEN = 1) geometry is possible (see Figure 3). If there does not exist any ambiguity about the path, the value of LEN is ignored; however, a non-blank field must be provided, as discussed above.

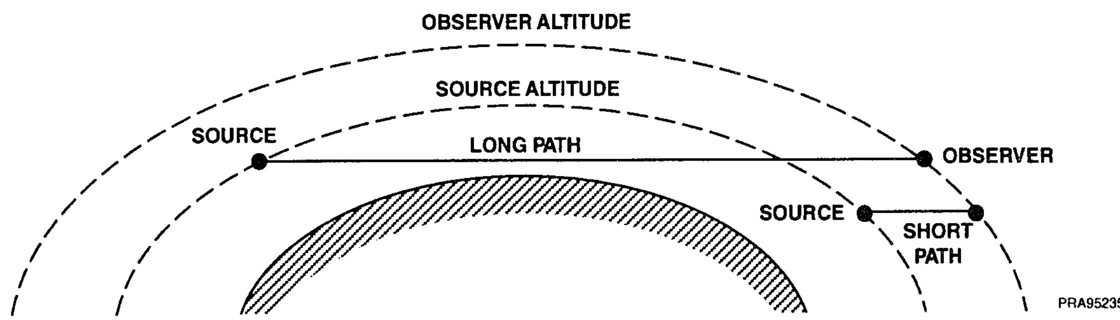


Figure 3. Long Versus Short Path Ambiguity.

The Leading and the Trailing Indices

The meaning and significance of these indices are explained below. The Geometry Parameter section is also the place where the user specifies the type of calculation to be performed via the Leading Index "A", "S", "B", "C", "L", or "H". Table 1 summarizes the type of calculation corresponding to each leading index. If look angles are required, they can be input by suffixing the leading index by a trailing index which can be "z", "e", or "l", depending on whether the angles are zenith, elevation or the latitude/longitude pair.

Table 2 shows the correspondence between LOS designations between MODTRAN and MOSART. This table can be used as a guide to use MODTRAN-like geometry inputs for performing MOSART calculations. In general, all "S" type

calculations can be performed using MODTRAN-like cases 2A, 2B, 2C, and 2D line-of-sight geometry inputs and L type calculations can be done with cases 3A and 3B geometry inputs. The MODTRAN case 1B path is not listed, as it consists of a MODTRAN case 1A with a user-defined atmosphere. The exceptions to these general statements are important. MODTRAN cases 2A and 2B require the zenith angle at the observer. Therefore, for cases 2A and 2B MODTRAN-like inputs, the trailing index in the Geometry Parameter section must be "z". Only then will the angle input in the Geometry Parameter section be interpreted as the zenith angle at the observer. Similarly, the trailing index "z" is also required.

Table 2. MODTRAN Geometry Types.

MODTRAN		MOSART
Horizontal	1a 1b	H H + User-Defined
Vertical or Slant Path Between Two Altitudes	2a 2b 2c 2d	Sz Sz S S
Vertical or Slant Path to Space	3a 3b	Bz, Lz B, L

4.1.5 Spectral Parameters

The Spectral Parameters section defines the spectral region or regions over which the calculations are to be performed. The section looks like:

```
Spectral Parameters ----------------------------
 Spectral Calculations (MO/LO/MM) ...... MO
 Wavenumber or Wavelength (WN/WL/FR) ... WN
   Initial wavenumber (cm**-1/um/GHz) .. 8000.  2000.
   Final wavenumber (cm**-1/um/GHz) .... 1180.  2500.
   Calculation width (cm**-1/um/GHz) ...   10.    20.
  .
```

The first input line specifies the model that is to be used for the molecular absorption Spectral Calculations. The three (3) options are:

MO: MODTRAN calculation using 1 cm^{-1} band parameters,
LO: LOWTRAN calculations using 20 cm^{-1} band parameters, or

MM: Millimeter calculations using line-by-line calculations (not currently implemented).

WARNING: Currently the only option implemented is the MODTRAN calculation. The LOWTRAN calculation has been deleted, and the MMW calculation has not yet been implemented.

The next line specifies the units for the spectral calculations. These three options are:

WN: Wavenumber in cm^{-1}
WL: Wavelength in μm, or
FR: Frequency in GHz.

The inputs for these remaining lines must be in the units of cm^{-1} for WN, μm for WL, or GHz for FR. All the specifications for a given run must be consistent throughout. In other words, you cannot give the spectral limits in μm and the resolution in cm^{-1} or the values for spectral band in μm and another in GHz. The FR option is often used in the millimeter wave spectral region.

Up to twenty (20) different spectral calculations can be requested on the next four (4) lines.

The Initial and Final Input values for each spectral region are input, together with the calculation width and the resolution. The Calculation Width specifies the spectral increments that the program will use to calculate the various parameters. MOSART degrades the band model parameters to this spectral width. If spectral output files are requested (see below), the spectral values will be output for this increment.

Since MOSART performs all its spectral calculations in integer values of wavenumber, wavelength and frequency inputs are internally converted to integer values of wavenumber. If an input set is specified in wavelength, frequency, or fractional wavenumber, control over the exact values to be calculated is lost. MOSART selects the integer values of the wavenumber interval that is closest to the desired values and encompasses them. All calculations are performed at these wavenumber values, rather than at the specified ones. The spectral values written to output files will be those that were calculated, rather than those requested. For example, if a spectral band of 3.0 to 6.0 μm (1666.67 cm^{-1} to 3333.33 cm^{-1}) is specified, the band will be changed to 1666 cm^{-1} to 3334 cm^{-1}. In such cases, the calculated band may be slightly larger than requested.

Inputting the spectral limits in wavelength is advantageous in shorter wavelengths, especially in the visible and ultraviolet. MOSART will automatically increase the size of the calculation grid in wavenumber at the shorter wavelengths, thereby decreasing the execution time. For example, a calculation between 2 and 5 microns at 0.01 microns calculational width, starts with a wavenumber resolution of 4.0 cm^{-1} at 5 μm. However, at 2 μm the wavenumber resolution is 24.9 cm^{-1}, which will be rounded to 25 cm^{-1}. If wavenumber values were provided, the specified resolution would be a constant 4.0 cm^{-1} over the whole spatial region, requiring 751 spectral calculations instead of 301.

4.2 Optional Input File Sections

The rest of the input file consists of the optional sections. As their name implies, MOSART can calculate the path transmittance(s) and radiance(s) without these inputs. However, it must be emphasized that it is through effective utilization of these optional sections that the user is able to take advantage of the many options and models in MOSART. More importantly, the atmosphere itself exhibits an incredibly wide range of variation, much more than this or any other model can grasp; for many applications it is important that the user explore some of these variations in order to assess their impact on this particular problem.

4.2.1 User-Defined File Names

The User-defined File Names section allows the user to provide supplemental input files to replace default models in MOSART. This section should be the first optional section, if used. This section looks like:

```
User-defined file names ------------------------------
 User-defined Atmosphere File Name ..... None
 User-defined Background File Name ..... None
 User-defined Hydrometeors File Name ... None
 User-defined Aerosols File Name ....... None
 Filter Response File Name ............. None
 .
```

For each File Name, either the string "None" (case insensitive), blanks, or a file name is expected. This file name can contain up to 40 characters. If any response other than "None" or blanks is received, MOSART will attempt to OPEN the file name given. The file is assumed to exist already. An error message will be output if the file name does not exist, and the job will terminate. These files are described in Sections 4.4 through 4.8.

4.2.2 File Retention Specifications

The File Retention Specifications section allows the user to save selected types of binary and ASCII output files for later use. Unless you have an auxiliary program (e.g., a plotting package, one of the MOSART utility programs) that uses one of the binary data files, there is no reason to retain any of the binary data files. Retention for each binary output file (for descriptions of contents, see below) is specified by a Yes ("Y" or "y"); otherwise, the file is never created. This section looks like:

```
File Retention Specifications -----------------------------
 Retain Atmospheric Binary File (Y/N) ... No
 Retain Background Binary File (Y/N) .... No
 Retain Plume Binary File (Y/N) ......... No
 Retain Multiple Scattering File (Y/N) .. No
 Retain Heat Transfer File (Y/N) ........ No
 Retain Transmittance File (Y/N) ........ No
 Retain TAPE7 (MODTRAN) File (Y/N) ...... No
 Retain TAPE8 (MODTRAN) File (Y/N) ...... No
 Retain DIS In-Band File (Y/N) .......... No
 .
```

4.2.3 Atmospheric Parameters

The Atmospheric Parameters section allows the user to specify various atmospheric parameters. The section looks like:

```
Atmosphere Parameters -----------------------------
 Model Atmosphere Latitude (0 - 10) ..... Midlatitude
 Season (Latitude dependent) ............ Summer
   Pressure Profile (0 - 24) ............
   Temperature Profile (0 - 24) .........
   Molecular Conc. Profile (0 - 24) .....
 Boundary Layer Aerosol Model (0 - 13) .. Rural
   Air Mass Character Index (0 - 10) ....
   Elapsed Time (days) since land .......
   Radon 222 Concentration (pCi/m**3) ...
 Stratospheric Aerosol Model (0 - 5) .... Background
 Tropo/Stratosph. Haze Profile (0 - 5) .. Background
 Mesospheric Haze Profile (0 - 2) ....... Normal
 Surface Air Temperature (K) ............
 Surface Cn**2 (m**-2/3) ................
 Current Wind Speed (m/sec) .............
 24-hour Mean Wind Speed (m/sec) ........
 Av. High Altitude Wind Speed (m/sec) ...
 Vertical Structure Algorithm (Y/N) ..... No
   Inversion Layer Altitude (km) ........
 Meteorological Range (km) .............. 23.0
 .
```

Note: Unlike MODTRAN, MOSART requires a Meteorological Range (last entry above) or sets it to the default value defined by the Boundary Layer Aerosol.

For the model atmosphere, season, boundary layer aerosol, stratospheric aerosol, and haze profile, a number of mnemonics are available (see below). The mnemonic must match one of those shown for the first N characters after all leading blanks are stripped off. For example, "Midlatitude" is an acceptable mnemonic for "Midlat". The input is case insensitive. The numeric value is also permitted.

4.2.3.1 Model Atmosphere

The model atmosphere input selects either one of the model atmosphere profiles or a user-specified profile (=10) (see Table 3). Note that MOSART will select a profile based on latitude and time if a zero (0) is entered. The model profiles specify pressure, temperature, and molecular concentrations for seven (7) molecules as a function of altitude.

4.2.3.2 Season

The season is model atmosphere dependent and is specified as shown in Table 3.

The user is allowed to select Pressure, Temperature, and Molecular Concentration Profiles that differ from those normally in the model atmosphere. For example, one could select a Midlatitude Summer atmosphere, but use the pressure profile from a Subtropical Winter atmosphere by placing the number 7 in the Pressure Profile line. There are no mnemonics available for these three inputs. See Table 4 for the proper values.

4.2.3.3 Aerosol Models

Following the work of Eric Shettle for LOWTRAN and MODTRAN, the models for atmospheric aerosols are divided into four (4) altitude regions. These regions are shown in Figure 4. Note that the boundaries between aerosol regions in MOSART can either be defined by the troposphere and stratosphere or be preset using the MODTRAN altitudes.

The Boundary Layer and Stratospheric aerosol types are specified in Tables 8 and 9, with corresponding mnemonics in Table 5. The Tropospheric and Stratospheric haze profiles and mnemonics are specified in Tables 6 and 10. The Mesospheric Haze Profile and mnemonics are in Table 7.

Table 3. MOSART Model Atmosphere and Season Inputs.

Model Atmosphere Latitude Index (ITYPE)	Degrees North Latitude	Model Atmosphere Name and Mnemonic*	Season Index (ISEASN)						
			0	1	2	3	4	5	6
			Global	Summer	Winter	Spring Fall Autumn Annual (none)	(none)	(none)	(none)
0	All	Global							
1	0	Equatorial		Summer (July)	Winter (Jan)				
2	15	Tropical		Summer (July)	Winter (Jan)	MODTRAN Annual Model[1]			
3	30	Subtropical		Summer (July)	Winter (Jan)				
4	45	Midlatitude		Summer (July)[2]	Winter (Jan)[3]	Spring/Fall			
5	60	Subarctic		Summer (July)[4]	Winter (Jan)[5]	Model A (warm)	Model B (warm)	Model C (warm)	Model D (cold)
6	75	Arctic		Summer (July)	Winter (Jan)				
7	90	Polar		Summer (July)	Winter (Jan)				
8	45	1976** U.S. Standard+ [6]		Spring/Summer Haze Profile	Fall/Winter Haze Profile				
9	32	1980** Israeli Standard++		Spring/Summer Haze Profile	Fall/Winter Haze Profile				
10		User** Defined [7]		Spring/Summer Haze Profile	Fall/Winter Haze Profile				

* Only the first six characters are matched
** The Season Index selects the haze profile for this Model Atmosphere Latitude Index
\+ Mnemonic = USSA
\++ Mnemonic = Israel

Superscript numbers indicate MODTRAN model atmosphere number

Table 4. Model Atmosphere Indices.

Index	Pressure Temperature and Molecular Concentration Profiles
0	Default to That Selected by ITYPE and ISEASN
1	Equatorial Summer (July)
2	Equatorial Winter (January)
3	Tropical Summer (July)
4	Tropical Winter (January)
5	Tropical MODTRAN Annual
6	Subtropical Summer (July)
7	Subtropical Winter (January)
8	Midlatitude Summer
9	Midlatitude Winter
10	Midlatitude Spring/Fall
11	Subarctic Summer
12	Subarctic Winter
13	Subarctic Model A (Warm)
14	Subarctic Model B (Warm)
15	Subarctic Model C (Warm)
16	Subarctic Model D (Cold)
17	Arctic Summer (July)
18	Arctic Winter (January)
19	Polar Summer (July)
20	Polar Winter (January)
21	U.S. Standard (1976)
22	Israeli Standard Day
23	Israeli Standard Night
24	User-Defined

Altitude	Aerosol	Region
Altitude	Meteoric Dust (set by IUPPER)	Mesosphere
Stratopause (nominally 35 - 50 km)	Stratospheric Aerosol (set by IAERO2, IHAZE and ISEASN)	Stratosphere
Tropopause (nominally 8 - 16 km)	Tropospheric Aerosol (set by IHAZE and ISEASN)	Troposphere
Scaled Altitude Above Background	Boundary Layer Aerosol (set by IAER01 and VIS)	Boundary Layer
Background Altitude		

Figure 4. Atmosphere/Aerosol Regions.

Table 5. Boundary Layer and Stratospheric Aerosol Model Mnemonics.

No.	5-Character Mnemonic	Aerosol
0	Rural	Rural Aerosol
1	Rural	Rural Aerosol
2	Urban	Urban Aerosol
3	Marit	Maritime Aerosol
4	Ocean	Navy Oceanic Aerosol
5	Tropo	Tropospheric Aerosol
6	Deser	Desert Aerosol
7	Advec	Advection Fog Aerosol
8	Radia	Radiation Fog Aerosol
9	Lt Ru	Light Rural Fog Aerosol
10	Lt Ur	Light Urban Fog Aerosol
11	Lt Ma	Light Maritime Fog Aerosol
12	Unuse	Not used at this time
13	Lt Tr	Light Tropospheric Fog Aerosol
14	Backg	Background Stratospheric Aerosol (Temperature Dependent)
15	*****	Background Stratospheric Aerosol (MODTRAN)
16	Aged	Aged Volcanic Stratospheric Aerosol
17	Fresh	Fresh Volcanic Stratospheric Aerosol
18	Meteo	Meteoric Dust Aerosol
19	User	User-defined Aerosol

"******" implies that no mnemonic is available

Table 6. Tropospheric and Stratospheric Haze Profile Mnemonics.

No.	6-Character Mnemonic	Haze Profile
-1	*****	No Aerosols included
0	Backgr	Background Stratospheric
1	Backgr	Background Stratospheric
2	Modera	Moderate Volcanic
3	High V	High Volcanic
4	Extrem	Extreme Volcanic
5	*****	Background Stratospheric (MODTRAN)
6	*****	Moderate Volcanic (MODTRAN)
7	*****	High Volcanic (MODTRAN)
8	*****	Extreme Volcanic (MODTRAN)
9	User-d	User-defined Profile

"*******" implies that no mnemonic is available

Table 7. Mesospheric Haze Profile Mnemonics

No.	4-Character Mnemonic	Haze Profile
0	Norm	Normal
1	Norm	Normal
2	Extr	Extreme

4.2.3.4 Boundary Layer Aerosol

The Boundary Layer extends from the ground (normally 0 km) to approximately 2 km above the background altitude (or ground). Table 8 lists the aerosol models, their MOSART indices, and the typical conditions of aerosol model applications.

When an Oceanic (type 4) or Desert (type 6) Aerosol Model is selected for the boundary layer, some extra parameters are required to determine the aerosol population distribution. The Desert model requires only the current wind speed; the Oceanic model requires the current and 24-hour wind speeds, and the air mass character.

The Desert Aerosol Model is used to predict aerosol properties in arid and semi-arid regions during background and severe dust storm conditions. The model is based upon a number of measurements taken in desert and arid regions all over the world. The model separates the desert aerosol into its three main components (i.e., carbonaceous particles, water soluble particles, and sand), each with its own size distribution and index of refraction.

The current wind speed determines the relative mixing of these three components, as well as mass loading due to sand during dust storms. For calm winds, the desert aerosol is similar to the rural aerosol. The mode radius and standard deviation of the sand component increase with increasing wind speed. Therefore, the Current Wind Speed will determine both the Meteorological Range (or visibility), as well as the spectral variability of the aerosol absorption and scattering coefficients for the Desert Aerosol Model.

The Desert Aerosol Model is valid for wind speeds less than 30 m/sec.

The Oceanic Aerosol Model uses a combination of a "continental" component, a "stationary" component, and a "fresh" component, each of which are described by

Table 8. Boundary Layer Aerosol Models.

Boundary Layer Aerosol Model Index	Aerosol Composition Model Name	Description	Recommended Typical Meteorological Range (km)	MODTRAN IHAZE Parameter
0	Default	Default to model selected by VIS	23.0	-
1	Rural	Continental areas not directly influenced by urban industrial sources (very clear air)		1
2	Urban	Stagnant, polluted air with combustion products and industrial aerosols	5.0	5
3	Maritime	Coastal areas with two components: sea spray and continental component similar to the rural model		4
4	Oceanic	Open ocean	Additional Input Required	3
5	Tropospheric	Extremely clear conditions	50.0	6
6	Desert	Continental areas with sparse vegetation	Additional Input Required	10
7	Advection Fog	The mixing of air masses with different temperatures and/or humidities	0.2	8
8	Radiation Fog	Air cooling to the point where air temperature approaches dew-point temperature	0.5	9
9	Light Rural Fog	Rural model modified to 99% relative humidity	1.0	-
10	Light Urban Fog	Urban model modified to 99% relative humidity	1.0	-
11	Light Maritime Fog	Maritime model modified to 99% relative humidity	1.0	-
12	Undefined at this time			
13	Light Tropospheric Fog	Tropospheric model modified to 99% relative humidity	1.0	-

NOTE: Unlike MODTRAN, MOSART has no default meteorological range for each aerosol model. If the Boundary Layer aerosol index is set to zero, the meteorological range will be used by the program to select a default aerosol composition model.

a log-normal distribution. The analytical form of the three distributions are determined by the air mass character for the continental influence, and the past 24-hour wind history for the stationary component, and the current wind speed for the fresh component.

The air mass character can be specified or calculated from the days since the air mass was over land or from the radon concentration. The design limits of the Oceanic aerosol model are:

- The relative humidity must be greater than 50% and less than 98%.
- The current and the 24-hour mean wind speed must be greater than 0.0 m/sec and less than 20.0 m/sec.
- The meteorological range must be greater than 0.8 km and less than 80.0 km.

The Air Mass Character Index gives a qualitative indication of the continental contribution to the aerosol population, being equal to one for a pure open ocean maritime aerosol and equal to ten for an aerosol with strong continental influence. This index can either be chosen subjectively by selecting an integer between 1 and 10 to signify the amount of continental influence, or, if more information is available, computed according to the values specified for the elapsed time or the Radon 222 concentration, described below.

The Elapsed Time (in days) since the air parcel left land is used to calculate the air mass character index according to:

$$\text{integer}\ (9 * \exp(-ELPST/4)) + 1\ .$$

If the elapsed time is left blank, the current Radon 222 Concentration (pCi/m^3) is used to calculate the air mass character index according to:

$$\text{integer}\ (RADON/4) + 1\ .$$

MOSART uses the first non-blank value of the three quantities, namely:

(1) air mass character index,
(2) elapsed time,
(3) radon 222 concentration.

4.2.3.5 Stratospheric Aerosols

The stratospheric aerosol composition and particle distribution models are shown in Table 9.

Table 9. Stratospheric Aerosol Model.

Index	Name	Description
0	Default	Model selected by IHAZE
1	Background	Representative of 1980 stratospheric conditions; base aerosol level
2	Aged Volcanic	Increase in background aerosol levels due to the injection of dust from massive volcanic eruptions; represents aerosols a year or more after an eruption; typical between 1980 and 1986, and after Mt. Pinatubo
3	Fresh Volcanic	Increase in background aerosol levels less than one year after a volcanic eruption
4	Meteoric Dust	Mesosphere aerosol model
5	User Defined	Input using user-defined input file

4.2.3.6 Tropo/Stratospheric Haze Profile

A vertical aerosol extinction model must be selected to use with the tropospheric and stratospheric aerosol composition and population distribution (see Table 10). If not defined by the user, a default aerosol population distribution model will be selected according to the vertical distribution model. Note that the distributions chosen are also modified by the season (see Technical Reference Manual).

4.2.3.7 Mesospheric Haze Profile

The aerosol altitude distribution model for the mesosphere (nominally 35 - 50 km) is defined separately from the troposphere and stratosphere. The two options (i.e., normal and extreme) are shown in Table 11.

4.2.3.8 Surface Air Temperature

The Surface Air Temperature (in K) is the air temperature at the background altitude. **If the air temperature is set to 0.0, the default temperature is obtained from the model atmospheric profile. If left blank, the temperature is obtained from the global data base.** If the global background is selected, the global data base overrides the input. This value is used to modify the first 2.0 km of the atmospheric profile if a non-zero value is either input or obtained from the internal

Table 10. Tropo/Stratospheric Haze Model.

Index	Name	Description	Default Aerosol Model
0	Default	Defaults to Background Volcanic Model	Background
1	Background	Represents a base haze level without recent volcanic activity	Background
2	Moderate Volcanic	Represents stratospheric vertical distribution conditions at least one year after volcanic activity	Aged Volcanic
3	High Volcanic	Represents stratospheric vertical distribution conditions less than one year after volcanic activity	Fresh Volcanic
4	Extreme Volcanic	Similar to High Volcanic, only more extreme	Fresh Volcanic
5	User Defined	Input using user-defined haze profile as part of the user-defined atmosphere option	-

Table 11. Mesospheric Haze Profile.

Index	Description
0	Default to Normal Vertical Distribution Model
1	Normal Vertical Distribution Model
2	Extreme Vertical Distribution Model

data base. The profile is modified to start with the surface temperature and to fair into the selected profile at 2 km altitude.

4.2.3.9 Surface Turbulence

The Surface C_n^2 (in $m^{2/3}$) is the standard air structure parameter for fluctuations in the index of refraction. It is used to predict scintillation (i.e., variations in the effective transmittance) and atmospheric radiance fluctuations (i.e., sky noise).

4.2.3.10 Wind

Three parameters are used to define the atmospheric wind:

- Current Wind Speed;
- 24-hour Mean Wind Speed;
- Av. High Altitude Wind Speed.

The Current Wind Speed (in m/sec) is used to determine the background material temperatures. Default values are used if zero values are input. Default value for the wind speed is model atmosphere dependent (see Table 12).

Table 12. Default Values for 24-Hour Mean Wind Speed.

Latitude	Season	24-Hour Mean Wind Speed (m/sec)
0°	Summer	4.10
0°	Winter	4.10
15°	Summer	4.10
15°	Winter	4.10
15°	Annual	4.10 (*)
30°	Summer	4.10
30°	Winter	6.69
45°	Summer	4.10 (*)
45°	Winter	10.29 (*)
45°	Spring/Fall	7.20
60°	Summer	6.69 (*)
60°	Winter	12.35 (*)
60°	Winter (Model A)	12.35
60°	Winter (Model B)	12.35
60°	Winter (Model C)	12.35
60°	Winter (Model D)	12.35
75°	Summer	6.69
75°	Winter	14.41
90°	Summer	6.69
90°	Winter	16.47
-	U.S. Standard (1976)	7.20
-	Israeli Standard (1980)	6.69
(*) MODTRAN Values		

The 24-hour Mean Wind Speed (in m/sec) defines the part of the maritime aerosol composition that depends on the present and past history of the wind. It represents that portion of the aerosol spectra that is produced by high wind and

white water phenomenon but does not precipitate out directly. If WWH is zero or negative, a default value will be chosen that depends on the model atmosphere selected. See Table 12 for default values.

The Average High Altitude Wind Speed (in m/sec) is used to define the C_n^2 profile above the boundary layer. The default value is 27 m/sec.

4.2.3.11 Vertical Structure Algorithm

The Vertical Structure (Y/N) input parameter specifies whether or not the aerosol particle distribution varies with altitude in the boundary layer (i.e., 0 - 2 km). This is the Army aerosol model in LOWTRAN and MODTRAN. The operation of the vertical structure algorithm is controlled by five parameters: meteorological range, aerosol type, the cloud ceiling height, cloud thickness and the altitude of the inversion or boundary layer. All these parameters except the altitude of the inversion layer are discussed elsewhere.

There are four cases for the vertical structure algorithm:

- Cloud/fog layer,
- Haze/light fog below cloud layer,
- Radiation fog/haze with no cloud layer,
- No cloud layer or boundary layer.

Table 13 shows what the five parameters need to be for each case. Note that there can be vertical structure with or without a cloud layer. Refer to the LOWTRAN 6 manual for more information on the vertical structure algorithm.

4.2.3.12 Meteorological Range

The sea-level meteorological range (in km) is used to determine the aerosol concentration in the boundary layer. If the aerosol composition and population distribution model has not been previously defined, then a default boundary layer aerosol composition model is set according to the input meteorological range. The meteorological range can be estimated as 1.3±0.3 times the visibility. Default aerosol models are shown in Table 14.

The aerosol altitude distributions are shown in Figure 4.

Table 13. Vertical Structure Algorithm.

Case	Selected By
1) Fog/Cloud	IVSA = 1, VIS ≤ 0.5 km ICLOUD = 1, HCLDBS > 0.0 ZINVSA Value is Ignored
2) Haze/Light Fog Below Cloud Layer	IVSA = 1, 0.5 ≤ VIS ≤ 10 km ICLOUD = 1, HCLDBS > 0.0 ZINVSA Value is Ignored
2′) Moderate/High Visibility Below Cloud Layer	IVSA = 1, VIS > 10 km ICLOUD = 1, HCLDBS > 0.0 ZINVSA Value is Ignored
3) Radiation Fog/Haze No Cloud Layer	IVSA = 1, VIS > 0.5 km ICLOUD = 0 ZINVSA = Defined Value
4) No Boundary Layer or Cloud Layer	IVSA = 1, VIS > 0.5 km ICLOUD = 0 ZINVSA = Defined Value

Table 14. Default Meteorological Ranges.

Range (km)	Default Model Used
0.0 → 10.0	Rural
0.0 - 0.2	Advection Fog
0.2 - 1.0	Radiation Fog
1.0 - 2.0	Light Rural Fog
>2.0	Rural

4.2.4 Solar and Lunar Parameters

The Solar and Lunar Parameters section allows the user to select the external light sources: solar, lunar, both, or neither. This section looks like:

```
Solar and Lunar Parameters -----------------------------
 Geometry Specification (EP/EA/ZA/LL) ... EP
 Type of Solar Calculations (S/C/N) ..... Complex
   Solar Elev./Zen./Latitude (deg) ......
   Solar Azimuth/Longitude (deg) ........
   Relative Solar Distance ..............
 Type of Lunar Calculations (S/C/N) ..... None
   Lunar Elev./Zen/.Latitude (deg) ......
   Lunar Azimuth/Longitude (deg) ........
   Relative Lunar Distance ..............
   Lunar Phase (deg) ....................
```

The solar and lunar Geometry Specification has four (4) different inputs:

EP: Ephemeris Calculations (see comments in Section 4.1.2)
EA: Solar/lunar elevation and azimuth angles
ZA: Solar/lunar zenith and azimuth angles
LL: Latitude and longitude of the subsolar and sublunar points

If ephemeris calculations are selected, it is not necessary to provide any solar or lunar position (or lunar phase) information. Otherwise, the user defines one of the three (3) types of angle sets as specified for either the sun and/or the moon. For the sun and moon, the user must specify the Type of Solar or Lunar Calculation desired:

S: Simple
C: Complex
N: None

The concept of simple versus complex solar and lunar calculations is explained in detail in the Technical Reference Manual. In summary, the simple calculation is recommended for high elevation angles (i.e., well above 30 degrees), because significant savings in computer time are realized with only a small loss in accuracy. For the simple calculations, any correlation between the solar and observer lines-of-sight is ignored, and the solar irradiance depends on the altitude, but not the azimuth. The complex calculations, on the other hand, take band correlation into account for all paths, and determine azimuthal variations in the solar flux. For low elevation angles (including solar/lunar positions below the optical horizon), complex calculations are a necessity.

The input values for the Relative Solar and Lunar Distances are normalized relative to their mean values of 1.49E+08 km and 3.8E+05 km, respectively. For the solar geometry, this results in a solar constant of 1373 W/m^2. The Lunar Phase is 0 degrees for a new moon, 180 degrees for a full moon, and 360 degrees for the

next new moon. Due to asymmetries in the lunar surface, the lunar irradiance is not symmetrical (i.e., the 90 degree, or first quarter, irradiance is not the same as the 270 degree, or last quarter, irradiance).

It should be noted that elevation (or zenith) and azimuth angles are defined with respect to either the observer or source, depending upon which option is specified in the Position Parameters section.

4.2.5 Hydrometeor Specifications

There are a number of possible cloud parameters that can be defined as follows:

```
Hydrometeor Specifications -----------------------------
 Cloud/Rain/Fog Model Desired (Y/N) ..... No
   Cloud/Rain/Fog Index (1 - 21) ........
   Snow Crystal Tape (1 - 6) ............
 Cirrus Cloud Type (N/ST/SV/HL) ......... None
   Cirrus Cloud Base Altitude (km) ......
   Cirrus Cloud Thickness (km) ..........
   Cirrus Extinct. (km**-1 at 0.55 um) ..
   Cirrus Equiv. LWC (gm/m**3) ..........
```

If the Cloud/Rain/Fog Model Desired option is selected ("Yes"), then one chooses the particular model by entering the appropriate Cloud/Rain/Fog Index, as shown in Table 15.

The choice of the rain model is governed by the rain rate, but the user can select the Snow Crystal Type according to the index, shown in Table 16.

Two of the Cirrus Cloud Types are essentially the same as the Standard (ST) and Subvisual (SV) cirrus cloud models in LOWTRAN 7. The third cirrus cloud model is based upon the work of Heymsfield (HL) where the particle size distribution and liquid water content are dependent upon the local air temperature. The user is referred to the Technical Reference Model for more details. For the cirrus cloud, the user specifies the Cirrus Cloud Base Altitude (in km) and the Cirrus Cloud Thickness (in km). For the Standard or Subvisual cloud model, the user can specify either the Cirrus Extinct, the extinction coefficient at 0.55 μm (in km^{-1}), or the Cirrus LWC (liquid water content) (in gm/cm^3). If neither is defined, MOSART assigns a default value for the extinction coefficient of 0.14 times the cloud thickness.

For the Heymsfield Cirrus Model, the local air temperature defines the liquid water content and the extinction coefficient.

Table 15. Cloud/Rain/Fog Index.

Index	Description	Altitude
1	No clouds, fog, or rain models	
2	Advection Fog Model No. 1	0 - 150 meters
3	Advection Fog Model No. 2	0 - 150 meters
4	Radiation Fog Model No. 1	0 - 75 meters
5	Radiation Fog Model No. 2	0 - 75 meters
6	Cumulus Cloud Model	0.66 - 2.70 km
7	Altostratus Cloud Model	2.40 - 2.90 km
8	Stratocumulus I Cloud Model	0.66 - 1.32 km
9	Nimbostratus I Cloud Model	0.16 - 1.00 km
10	Stratus I Cloud Model	0.16 - 0.66 km
11	Stratus II Cloud Model	0.33 - 1.00 km
12	Stratus - Stratocumulus Cloud Model	0.66 - 2.00 km
13	Stratocumulus II Cloud Model	0.66 - 2.00 km
14	Nimbostratus II Cloud Model	0.16 - 0.66 km
15	Cumulus-Cumulus Congestus I Cloud Model	0.66 - 2.70 km
16	Cumulus-Cumulus Congestus II Cloud Model	0.66 - 3.40 km
17	Stratus II Cloud - Drizzle (2.0 mm/hr)	0.33 - 1.00 km
18	Nimbostratus II Cloud - Light Rain (5.0 mm/hr)	0.16 - 0.66 km
19	Nimbostratus II Cloud - Medium Rain (12.5 mm/hr)	0.16 - 0.66 km
20	Cumulus Cloud - Heavy Rain (25.0 mm/hr)	0.66 - 2.70 km
21	Cumulus Cloud - Extreme Rain (50.0 mm/hr)	0.66 - 2.70 km
22	User-defined Cloud/Fog/Rain Profile	

Table 16. Snow Crystal Type.

Index	Azimuth
1	Needle Crystals
2	Plain Dendritic Crystals
3	Spatial Dendritic Crystals
4	Powder Snow Crystals
5	Crystal with Droplet
6	Graupel

4.2.6 Terrain Specifications

The specification of terrain properties requires the following set of parameters:

```
Terrain Specifications -----------------------------
 Earth Background Index (0 - 63) ........ No
 Earth Background Altitude (km) ......... 0.0
 Initial Background Altitude (km) ....... 0.0
 Final Background Altitude (km) ......... 0.0
 Fore/Background Altitudes (F/B) ........ Fore
 Cloud Cover (percent) (l/m/h) .......... 0. 0. 0.
 Cloud Base Altitude (km) (l/m/h) ....... 1. 3. 5.
 Cloud Top Altitude (km) (l/m/h) ........ 2. 4. 6.
  .
```

The Earth Background Index allows the user to select the terrestrial surface material(s). Currently, there are 63 generic earth backgrounds available; these are listed in Table 17. If the global option is chosen, the geometry will determine the background scene. If the observer-source geometry is such that the line-of-sight does not terminate at the earth's surface, the program automatically recognizes this and takes appropriate action. Nevertheless, the user should always select a reasonable terrain type, since the earth background type impacts many aspects of the calculations.

There are two background types: multi-material GENESSIS-based backgrounds and single material backgrounds.

The data for the multi-material GENESSIS backgrounds is based on background scenes generated by the GENESSIS code. The data consists of the percentage of each material in the background and spectral reflectivity and diurnal temperature variation for each material. For example, the Arctic/Tundra Land-Sea Interface Background is 12% water, 31% ice, and 57% tundra. The final background radiance is calculated according to the percentage of each material in the background. The variance of the background radiance given in the MOSART output files is the weighted standard deviation of the final radiance calculated for each individual material within the background. The second background group consists of single materials, allowing the user to select uniform backgrounds of one type. More information on these background types is given in the Technical Reference Manual.

The Earth Background Altitude (in km) is the actual altitude of the earth below the source or observer, depending upon the reference frame selected. Specifying a background altitude allows the user to model realistic locales. The temperature,

Table 17. Earth Background Indices.

Index	Description
0	Global Backgrounds
1	City/Harbor Land/Sea Interface (San Diego, CA)
2	Arctic Tundra Land/Sea Interface (Pt. Barrow, AK)
3	Forested Low Relief Terrain (Wa Wa, Ontario, Canada)
4	Subarctic Rocky Land/Sea Interface (Trondheim, Norway)
5	Forested Terrain/Agricultural Terrain (Fulda, Germany)
6	Flat Agricultural Terrain (Alberta, Canada)
7	Desert Pavement with Dunes Terrain (Imperial Valley, CA)
8	Desert Land/Sea Interface (Salton Sea, CA)
9	Forested Mountains/Cultural Terrain (Santa Cruz, CA)
10	Multi-Year Sea Ice (Beaufort Sea)
11	Arctic Mountains with Scrub Terrain (Brooks Range, AK)
12	Arctic Tundra with Melt Lakes Terrain
13	Open Ocean/Lake Background
14	Mixed Farmland/Orchards Terrain (Camarillo, CA)
15	Southern California Land/Sea Interface (Southern California)
16	Tundra Background (Type No. 1)
17	Pine Forest Background
18	Mixed Forest/Farmland Background
19	Grassland/Savannah Background
20	Scrub/Chaparral Background
21	Scrub Desert Background
22	Urban Background
23	Rural Land/Sea Interface Background
24	Tropical Forest Background
25	Tropical Savannah Background
26	Tropical Desert Background
27	Tropical Land/Sea Interface Background
28	Continental Ice
29	Urban/Commercial Background
30	Urban/Residential Background
31	Tilled Soil/Farmland Background

Table 17. Earth Background Indices (continued).

Index	Description
32	Tundra Background (Type No. 2)
33	Iraq and Syria Background
34	Iran Background
35	North Korea Background
36	Pakistan Background
37	Kern River, California Background
38	USA (North America) Background
39	Global Background
40	Undefined Background
41	Undefined Background
42	User-defined Background
43	Fresh Water Background Material
44	Sea Water Background Material
45	MODTRAN Ocean Background Material
46	GENESSIS Water Ocean Background Material
47	First Year Ice Background Material
48	Multi-Year Ice Background Material
49	Dry Snow Background Material
50	Wet Snow Background Material
51	MODTRAN Snow Cover (Fresh) Background Material
52	GENESSIS Fresh Snow (50 micron radius) Background Material
53	GENESSIS Old Snow (1000 micron radius) Background Material
54	Undefined Background Material
55	Undefined Background Material
56	Undefined Background Material
57	Undefined Background Material
58	MODTRAN Cloud Deck (diffuse only--6x for forward scatter)
59	Blackbody Background Material
60	Whitebody Background Material
61	Still Air Background Material
62	Undefined Background Material
63	Undefined Background Material

Table 17. Earth Background Indices (continued).

Index	Description
64	Undefined Background Material
65	Undefined Background Material
66	Undefined Background Material
67	Undefined Background Material
68	Dry grass (Dry meadow fescue grass) Background Material
69	MODTRAN Grass Background Material
70	MODTRAN Dead Grass Background Material
71	MODTRAN Burnt Grass Background Material
72	Lawn grass (Apple leaves to simulate irrigated crops)
73	Scrub (Bark/twigs/dry mixed pine needles/chaparral leaves)
74	Pine Trees (Mixed pine needles) Background Material
75	Broadleaf Trees (Summer) (Mixed broadleaf tree leaves)
76	Broadleaf Trees (Winter) Background Material
77	MODTRAN Forest Background Material
78	MODTRAN Farm Background Material
79	MODTRAN Maple Leaf Background Material
80	Undefined Background Material
81	Undefined Background Material
82	Undefined Background Material
83	Undefined Background Material
84	Undefined Background Material
85	Undefined Background Material
86	Undefined Background Material
87	Packed Soil (compacted California reddish clay loam)
88	Beach sand (Beach sand; silica sand and silt loam)
89	Limestone-Silt-Sand Background Material
90	Limestone-Silt Background Material
91	Salt-Silt Background Material
92	Silt-Sand Background Material
93	Limestone Rock (Solid limestone rock) Background Material
94	Sandstone Rock (Red) Background Material
95	Varnished Sand Background Material

Table 17. Earth Background Indices (continued).

Index	Description
96	Varnished Sandstone (Desert varnish) Background Material
97	Dry Silt Playa Background Material
98	Wet Silt Playa Background Material
99	Dry Silt-Salt Flats Background Material
100	Wet Silt-Salt Flats Background Material
101	MODTRAN Desert Background Material
102	Undefined Background Material
103	Undefined Background Material
104	Undefined Background Material
105	Undefined Background Material
106	Asphalt Background Material
107	Concrete Background Material
108	Building Roof (Galvanized Iron) Background Material
109	Undefined Background Material
110	Undefined Background Material
111	Undefined Background Material
112	Undefined Background Material
113	Undefined Background Material
114	Undefined Background Material
115	Undefined Background Material
116	User-defined Background Material
117	User-defined Background Material
118	User-defined Background Material

aerosol, and structure constant profiles are compressed or modified to fit the background altitude specified. If the global background (i.e., type 0) is selected, the geographical data base is used if this value is blank.

The Initial and Final Background Altitudes (in km) are used when atmospheric calculations to a set of altitudes are required. The background and multiple scattering binary files require output over a range of altitudes, as opposed to a single altitude (i.e., the source) used by the atmosphere and plume binary data files. To select the range of altitudes, the user must define the initial and final background altitudes (in km). Also, the Fore/Background Altitudes (F/B) must be specified for those cases where a ray intersects an altitude twice (e.g., in limb view). The user must specify whether the foreground (F) or background (B) is desired.

The last three options specify the cloud cover to be used for the solar insolation as part of the calculation of the terrain surface temperature. The Cloud Cover in percentage (%), the Cloud Base Altitude in kilometers, and the Cloud Top Altitude in kilometers can either be specified for the low, middle, and high (l/m/h) etage clouds or can be set to zero. The program expects three (3) values for each line. If no values are provided, then the program will use the information in the global data base for the latitude, longitude, date, and time provided.

It should be emphasized that these definitions of cloud cover and altitude are NOT used in the basic radiative transfer calculations. These cloud parameters are used in determining the amount of insolation and amount of shade in the calculation of the terrain material temperatures and in calculating the mean and standard deviation of the terrain radiances. If clouds are desired in the radiative transfer along the specified lines-of-sight, they must be defined according to Table 15.

4.2.7 Observer Parameters

The Observer Parameters describe properties of the observer's sensor that are required for calculating aperture-averaged scintillation and forward scatter into the aperture. If this section is not included, forward scatter into the aperture is not included in the output. The section looks like:

```
Observer Parameters ------------------------------
 Observer aperture diameter (m) ........ 1.
 Observer field-of-view (mrad) ......... 1.
.
```

The Observer aperture diameter (in m) and the Observer field-of-view (in mrad) are the two required parameters.

4.2.8 Extra Altitude Specifications

The Extra Altitude Specification section allows the user to insert additional altitudes in the altitude grid without changing the atmospheric profiles. The section looks like:

```
Extra Altitude Specifications ------------------------
 Extra Altitudes (km) .................. 1.
.
```

Up to a maximum of 100 Extra Altitudes can be input to MOSART. MOSART then establishes an internal grid for all ray propagation and integration. The extra altitudes are combined with those defined internally. MOSART checks for redundancy (i.e., an internal altitude and an extra altitude coinciding) and removes the extraneous one. Although up to 100 extra altitudes are allowed, the total number of altitudes (i.e., internally defined points plus some line-of-sight geometry points plus these extra altitudes) cannot exceed 100.

4.2.9 Source Earth/Skyshine Specifications

The Source Earth/Skyshine Specification section allows the user to calculate the apparent irradiance incident on the source over the full 4π steradians as a function of elevation and azimuth angles. The section looks like:

```
Source Earth/skyshine Specifications ------------------------
 Azimuth Grid Index (0 - 3) ..................
 Elevation Grid Index (0 - 14) ...............
 User-defined Grid (Y/N) ..................... No
   Azimuth grid (deg) (<=4) ..................
   Elevation grid (deg) (<=32) ...............
.
```

The earthshine and skyshine at the source are required for many background and hardbody signature calculations. If the earth/skyshine option is selected, it is necessary that the source coordinate reference frame be selected (see above), and to specify both the azimuth and elevation grids for which the earth/skyshine is to be calculated. The earth/skyshine azimuth angles (defined at the source) are selected by an index:

0 - 0, 90, and 180 degrees
1 - 0, 90, and 180 degrees
2 - 0, 90, 180, and 270 degrees
3 - 90 degrees only

The earth/skyshine elevation angles (defined at the source) are selected by an index:

0 - No skyshine (respond with "No" above)
1 - Full spherical coverage at 30 deg. increments plus ± horizon (9 pts)
2 - Full spherical coverage at 15 deg. increments plus ± horizon (15 pts)
3 - Lower hemispherical coverage with 30 deg. increments plus ± horizon (6 pts)
4 - Lower hemispherical coverage with 15 deg. increments plus ± horizon (9 pts)
5 - Upper hemispherical coverage with 30 deg. increments plus ± horizon (4 pts)
6 - Upper hemispherical coverage with 15 deg. increments plus ± horizon (7 pts)
7 - Special satellite coverage (geometry determines grid)
8 - Gauss-Legendre full spherical coverage (3 points)
9 - Gauss-Legendre full spherical coverage (5 points)
10 - Gauss-Legendre lower hemispherical coverage (3 points)
11 - Gauss-Legendre lower hemispherical coverage (5 points)
12 - Gauss-Legendre upper hemispherical coverage (3 points)
13 - Gauss-Legendre upper hemispherical coverage (5 points)
14 - User-defined elevation angles (respond with "Yes" below)

It should be noted that each earth/skyshine ray requested increases computational time, so an excessive number of lines-of-sight should not be selected.

If a user-defined set of earth/skyshine elevation angles are desired, respond with a "Yes" and provide the appropriate angles on the record provided (or records if "&"'s are used).

4.3 Optional Tabular Sections

Three (3) optional tabular sections are provided in tabular form:

1. Antecedent Specifications: This section provides MOSART with appropriate antecedent data calculating the earth surface temperatures.

2. User-defined Atmosphere Parameters: This section, which is a duplicate of the User-defined Atmosphere File, permits the various atmospheric parameters to be defined in the input file.

3. Background Material Temperatures: This section allows the user to define temperatures for some or all of the background materials.

4.3.1 Antecedent Specifications

The Antecedent Specifications section specifies the meteorological conditions for the 24 hours before the time for which the calculation of terrain temperatures is desired. The section is shown below:

```
Antecedent Specifications --------------------------------
 Hour  Srfc. Rel.  Wind  Srfc. ------------------- Clouds -----------------
 (LST) Temp. Hum. Speed Press. ----- Low ---- ----- Mid ---- ---- High ----
        (K)   %   (m/s)  (mb)   %   Base  Top  %   Base  Top  %   Base  Top
  0.0  260.  35.   4.10  1012. 30.0  3.2  3.4 20.0  4.5  4.7 10.0  5.8  6.0
  6.0  259.  35.   4.10  1012. 30.0  3.2  3.4 20.0  4.5  4.7 10.0  5.8  6.0
 12.0  275.  35.   4.10  1012. 30.0  3.2  3.4 20.0  4.5  4.7 10.0  5.8  6.0
 18.0  272.  35.   4.10  1012. 30.0  3.2  3.4 20.0  4.5  4.7 10.0  5.8  6.0
 24.0  260.  35.   4.10  1012. 30.0  3.2  3.4 20.0  4.5  4.7 10.0  5.8  6.0
End of Antecedent Data/
.
```

This section consists of the following parts:

- Section title (1 line)
- Column labels and units (3 lines)
- Antecedent parameters
- Termination line (1 line)
- Dot (".") (1 line)

The program interpolates the provided data in the 24-hour cyclic manner (e.g., if data is provided at 1.0 and 23.0 hours, the value at 24.00 will be interpolated from the data at 23.0 hours and 25.0 hours, which is assumed to be equal to the parameters at 1.0 hour). The parameters required are:

- Hour (Local Standard Time) (decimal hours)
- Surface air temperature (K)
- Surface relative humidity (%)
- Surface wind speed (m/sec)
- Surface pressure (mb)
- Low etage cloud cover (%), base altitude (km), and top altitude (km)
- Middle etage cloud cover (%), base altitude (km), and top altitude (km)
- High etage cloud cover (%), base altitude (km), and top altitude (km)

Any zero values given will be determined from either the global data base or the model atmosphere (i.e., relative humidity, wind speed, and pressure).

4.3.2 User-Defined Atmospheric Parameters

The User-defined Atmospheric Parameters section is identical to the User-defined Atmosphere file, which is discussed in Section 4.5. The section looks like:

```
User-defined Atmospheric Parameters --------------
 Radius of the earth (km) ............
 Atmospheric Header .................. Midlatitude Summer User-defined
 Input for Line 2 (Y/N) ............... Y
 Input for Line 3 (Y/N) ............... Y
 Input for Line 4 (Y/N) ............... N
 Input for Line 5 (Y/N) ............... N
 Input for Line 6 (Y/N) ............... Y
 Complete Profile with Model (Y/N) .... Y
.
Profiles:
 No.     Alt.   Pressure Temperature    H2O       CO2       O3
                  N2O       CO         CH4       O2        NO
                  SO2       NO2        NH3       HNO3      N2
                CFC-11    CFC-12     CFC-13    CFC-14    CFC-22
                CFC-113   CFC-114    CFC-115   Unknown   Unknown
                Unknown   Unknown    Aersol   Haze (km-1)   Cn2
        (km)    ---------- units depend on switch -------------------
Switches
   1 Surface  1013.25     288.15      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0         0.00      0.00    0 0 0 0 0
   2    1.500   982.00     276.01      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0         0.00      0.00    0 0 0 0 0
   3    2.500   952.00     268.00      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0.00      0.00      0.00    0 0 0 0 0
                 0.00       0.00      0         0.00      0.00    0 0 0 0 0
End of Profile Data/
.
```

4.3.3 Terrain Material Temperatures

The Terrain Material Temperatures section allows the user to define the temperature of appropriate terrain materials. The section looks like:

```
Terrain Matl. Temperatures (Sun/Shade) (K) -----------------
 Fresh Water .........................    0.00     0.00
 Sea Water ...........................    0.00     0.00
 MODTRAN Ocean .......................    0.00     0.00
 GENESSIS Water Ocean ................    0.00     0.00
 First Year Ice ......................    0.00     0.00
 Multi-Year Ice ......................    0.00     0.00
 Dry Snow ............................    0.00     0.00
 Wet Snow ............................    0.00     0.00
 MODTRAN Snow Cover (Fresh) ..........    0.00     0.00
 GENESSIS Fresh Snow (50 um radius) ...   0.00     0.00
 GENESSIS Old Snow (1000 um radius) ...   0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 MODTRAN Cloud Deck ..................    0.00     0.00
 Blackbody ...........................    0.00     0.00
 Whitebody ...........................    0.00     0.00
 Still Air ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Dry grass (Dry meadow fescue grass) ..   0.00     0.00
 MODTRAN Grass .......................    0.00     0.00
 MODTRAN Dead Grass ..................    0.00     0.00
 MODTRAN Burnt Grass .................    0.00     0.00
 Lawn grass (irrigated crops) ........    0.00     0.00
 Scrub ...............................    0.00     0.00
 Pine Tress (Mixed pine needles) ......   0.00     0.00
 Broadleaf Trees (Summer) ............    0.00     0.00
 Broadleaf Trees (Winter) ............    0.00     0.00
 MODTRAN Forest ......................    0.00     0.00
 MODTRAN Farm ........................    0.00     0.00
 MODTRAN Maple Leaf ..................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Packed Soil (reddish clay loam) ......   0.00     0.00
 Beach sand (silica sand/silt loam) ...   0.00     0.00
 Limestone-Silt-Sand .................    0.00     0.00
 Limestone-Silt ......................    0.00     0.00
 Salt-Silt ...........................    0.00     0.00
 Silt-Sand ...........................    0.00     0.00
 Limestone rock ......................    0.00     0.00
 Sandstone Rock (Red) ................    0.00     0.00
 Varnished Sand ......................    0.00     0.00
 Varnished Sandstone .................    0.00     0.00
 Dry Silt Playa ......................    0.00     0.00
 Wet Silt Playa ......................    0.00     0.00
 Dry Silt-Salt Flats .................    0.00     0.00
 Wet Silt-Salt Flats .................    0.00     0.00
 MODTRAN Desert ......................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Undefined ...........................    0.00     0.00
 Asphalt .............................    0.00     0.00
```

```
Concrete ............................    0.00     0.00
Building Roof (Galvanized Iron) ......   0.00     0.00
Undefined ...........................    0.00     0.00
Undefined ...........................    0.00     0.00
Undefined ...........................    0.00     0.00
Undefined ...........................    0.00     0.00
Undefined ...........................    0.00     0.00
Undefined ...........................    0.00     0.00
Undefined ...........................    0.00     0.00
User-defined ........................    0.00     0.00
User-defined ........................    0.00     0.00
User-defined ........................    0.00     0.00
.
```

Two (2) temperatures (in K) are required for each material. The first one is for sunlit materials and the other is for shaded materials. If a zero is entered, the program will either calculate the temperature from the antecedent specifications (see Section 4.3.1) or set the temperature to the ambient surface air temperature.

4.4 Filter Response Spectral Parameters File

The filter response spectral parameters file is used to integrate spectral calculations over the user's specified filter function. If no filter response file is given, a square spectral filter is assumed. When a filter response is provided, the spectral integration will include the response in this file. The CRFILE code can be used to create a template for the filter response spectral file that mimics the human eye photopic response (see Figure 5).

MOSART is capable of handling MODTRAN filter files. The user can either convert the MODTRAN filter file to a MOSART filter file using CRFILE (see Section 6.1) or by inputting the MODTRAN file directly (see Section 4.2.1).

The filter file can be used either by MOSART or, if any appropriate binary files are retained (see Section 4.2.2), by MRFLTR (see Section 6.5).

```
Filter Response Spectral Parameters File (Ver. 1.00)
.
Filter Name (<=24 characters) .......... Sample Spectral Filter
Wavenumber or Wavelength (WN/WL) ....... WL
.
Parameters:  Wavenumber/length     Normalized
                 (cm**-1/um)        Response
1                 0.370                    0.00000
2                 0.380                    0.00004
3                 0.390                    0.00012
4                 0.400                    0.0004
End of Spectral Data/
.
```

After the file Title (and "."), the user can specify a Filter Name, up to 24 CHARACTERs, which will appear in the ASCII output file. The user then specifies if the spectral values are specified as a function of Wavelength (in μm) or Wavenumber (in cm^{-1}).

Following the table headings, the filter is defined by a record number, the wavelength in microns, and the desired filter response. The spectral entries are terminated by the string "End of Spectral Data/", where the slash is used to terminate a list-directed READ.

Since MOSART extrapolates all values by setting the value to the first or last element in the array being interpolated, it is important to place zeroes at the beginning and the end of the spectral array.

Multiple, non-overlapping filters can be included in a single filter file. In this way, each spectral interval (see Section 4.15) can be convolved with its own filter, as long as each spectral interval is disjoint and non-overlapping.

For details on how to convolve a filter with an existing set of binary files, see Section 6.5.

4.5 User-Defined Atmospheric Parameters File

The user can define an atmospheric profile by specifying the pressure, temperature, molecular concentrations, aerosol type, haze profile, and turbulence structure constant separately. The CRFILE code can be used to create a template for the user-defined atmospheric profile (see Figure 7), or it can be placed within a standard MOSART input file (see Section 4.3.2).

```
User-defined Atmospheric Parameters File (MOSART Version 1.00)
.
 Radius of the earth (km) .............
 Atmospheric Header .................... Midlatitude Summer User-defined
 Input for Line 2 (Y/N) ............... Y
 Input for Line 3 (Y/N) ............... Y
 Input for Line 4 (Y/N) ............... N
 Input for Line 5 (Y/N) ............... N
 Input for Line 6 (Y/N) ............... Y
 Complete Profile with Model (Y/N) .... Y
.
Profiles:
 No.     Alt.   Pressure Temperature    H2O        CO2        O3
                   N2O       CO        CH4        O2         NO
                   SO2       NO2       NH3        HNO3       N2
                 CFC-11    CFC-12    CFC-13     CFC-14     CFC-22
                 CFC-113   CFC-114   CFC-115    Unknown    Unknown
                 Unknown   Unknown   Aerosol  Haze (km-1)   Cn2
        (km)    ---------- units depend on switch ------------------
Switches
   1 Surface   1013.25     288.15      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0                0.00       0.00    0 0 0 0 0
   2    1.500    982.00     276.01      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0          0.00       0.00    0 0 0 0 0
   3    2.500    952.00     268.00      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0.00       0.00       0.00    0 0 0 0 0
                  0.00       0.00      0          0.00       0.00    0 0 0 0 0
End of Profile Data/
.
```

The Radius of the earth (in km) is the first entry after the file title (and "."). If it is either blank or zero, it is calculated using the latitude.

The Atmospheric Header (up to 40 characters) is simply a title.

The Input for Lines 2,3,4,5,6 (Y/N) tells MOSART whether these lines are present, since a user-defined atmosphere can require up to six (6) lines per altitude. Line 1 for each altitude is always required.

The Complete Profile with Model (Y/N) line allows the user to have MOSART fill in atmospheric parameters below the lowest and above the highest user-defined altitudes with values from a model atmosphere.

The next eight lines are skipped as they are headers for the data entries. The first entry can be an altitude or "Surface" (case insensitive). In the latter case, the terrain altitude is taken from the Terrain Specifications menu (see Section 4.2.6) or the global data base. The switches on each line correspond to the atmospheric parameters on that line.

The Switches at the far right of each data line provide direction to the code with respect to which variables are being input and what units are being used:

Pressure index:
- 0 - model pressure profile defined by MP
- 1 - pressure in millibars
- 2 - pressure in atmospheres
- 3 - pressure in torr

Temperature index:
- 0 - model temperature profile defined by MT
- 1 - temperature in Kelvin
- 2 - temperature in degrees Centigrade
- 3 - temperature in degrees Rankin
- 4 - temperature in degrees Fahrenheit

Molecular index for H_2O, CO_2, O_3, N_2O, CO, CH_4, O_2, NO, SO_2, NO_2, NH_3, HNO_3, N_2, CFC-11, CFC-12, CFC-13, CFC-14, CFC-22, CFC-113, CFC-114, and CFC-115, respectively:
- 0 - model molecular concentration profile defined by MC
- 1 - volume mixing ratio (ppmv)
- 2 - number density (cm^{-3})
- 3 - mass mixing ratio (gm/kg)
- 4 - mass density (gm/m^3)
- 5 - partial pressure (mb)
- 6 - dew point temperature (K) (water vapor only)
- 7 - dew point temperature (°C) (water vapor only)
- 8 - relative humidity (°C) (water vapor only)

Aerosol index:
- 0 - internal profile
- 1 - user-defined profile

Haze index:
- 0 - internal profile
- 1 - user-defined profile

Structure constant index:
- 0 - internal profile
- 1 - user-defined profile

The atmospheric profile is then defined by:

Altitude of each layer (km)

Pressure of each layer (*)

Temperature of each layer (*)

Molecular concentration of each layer for H_2O, CO_2, O_3, N_2O, CO, CH_4 O_2, SO_2, NO_2, NO, NH_3, HNO_3, N_2, CFC-11, CFC-12, CFC-13, CFC-14, CFC-22, CFC-113, CFC-114, and CFC-115, respectively. Four spaces for "unknown" molecules have been included for future growth. (*)

Aerosol model type for each layer. (NOTE: In evaluating the aerosol type for intermediate altitudes (i.e., altitudes between two user-defined altitudes), the aerosol type for the lower altitude is used.)

Haze (i.e., aerosol extinction at 0.55 μm) for each layer (km^{-1})

Structure constant, C_n^2, for each layer ($m^{-2/3}$)

(*) Units depend upon the indices defined above.

Because of the READ format, <u>all entries</u> including zeros, must be given for each line!

The above format provides flexibility in regard to which parameters are specified, which are user-defined, and what units are used.

The profile table is terminated by the string "End of Profile Data/", where the slash is used to terminate a list-directed READ.

4.6 User-Defined Background Material/Scene File

The ability to define user-defined background scenes and/or materials is provided through the user-defined background material/scene file (see Figure 6). A template for this file can be generated with the CRFILE code.

The first part of the User-Defined Background Material/Scene File is as follows:

```
User-defined Background Material/Scene File (Version 1.40)
.
Number of background materials (<=3) ... 3
Labels (<=10 characters) (No. 1) ....... Example No. 1
Labels (<=10 characters) (No. 2) ....... Example No. 2
Labels (<=10 characters) (No. 3) ....... Example No. 3
.
Background type (0,1,2) ................ 0        0        0
Fractional diffuse component ........... 1.00     1.00     1.00
Roughness standard deviation (m) ....... 0.00     0.00     0.00
Roughness correlation length (m) ....... 0.00     0.00     0.00
Roughness correlation type (1,2) ....... 0        0        0
Fraction of air included ............... 0.00     0.00     0.00
Type of inclusion (1,2) ................ 0        0        0
Heat transfer flag (0,1,2,3) ........... 0        0        0
Solar absorptivity ..................... 0.80     0.20     0.50
Thermal emissivity ..................... 0.98     0.98     0.98
Thermal conductivity (w/m/K) ........... 0.90     0.70     0.50
Characteristic length (m) .............. 1.00     1.00     1.00
Specific heat (w-sec/gm/K) ............. 1.00     1.00     1.00
Density (gm/m**3) ...................... 1.3E+6   1.3E+06  1.3E+06
Thickness of material (m) .............. 1.       1.       1.
Index of first sublayer ................ 17       17       17
Thickness of first sublayer (m) ........ 10.      10.      10.
Index of second sublayer ............... 19       19       19
.
No. Wavelength (um) and aver. reflectance for each material
 1      0.2          0.55     0.70     1.00
 2      2.0          0.65     0.70     1.00
 3     20.0          0.75     0.70     0.90
 4    200.0          0.85     0.70     0.95
End of Spectral Data/
.
```

After the file title (and "."), the Number of background materials to be defined by the user is given. A maximum of three (3) materials is allowed. A Label for each of the materials which will appear in the ASCII output file is given in each of the next three lines. If less than three materials are specified, simply leave the labels blank.

The rest of these inputs specify various parameters for each of the three materials. The flags are defined as follows:

Background type:
- 0 - diffuse surface
- 1 - rough Fresnel surface
- 2 - bidirectional reflectance surface

Roughness correlation type:
- 1 - Gaussian roughness
- 2 - exponential roughness

Type of inclusion:

1 - Bruggeman effective medium
2 - Maxwell-Garnett effective medium

Heat transfer flag:

0 - calculate material temperature
1 - set material temperature equal to air temperature
2 - set material temperature equal to water temperature
3 - snow or ice; set material temperature to air temperature or to 273 K, whichever is smaller

The Fractional diffuse component defines for background types 1 and 2 the percentage of the reflectance which is diffuse. The Roughness standard deviation and Roughness correlation length are used for the bidirectional reflectance calculations. The Fraction of air included is used with the type of inclusion to modify the indices of refraction for ice and snow. The remaining terms are used in the calculation of the temperature: the Thermal conductivity (in W/m/K) refers to the rate of heat transfer to the subsurface; the Characteristic length (m) provides the coupling model constant between the wind and the surface for turbulent flow. The Specific heat (in W-sec/gm/K) and the Density (in gm/m^3) are used to determine the thermal mass of the material.

NOTE: Presently, user-defined materials cannot be type 2 (i.e., bidirectional), and inclusion of air is not permitted. All other parameters are valid.

The average (hemispherical) spectral reflectivity must be provided for each material. The spectral table is terminated by the string "End of Spectral Data/", where the slash is used to terminate a list-directed READ. The dot indicates the end of this data set.

The second part of the User-Defined Background Material/Scene File follows:

```
Scene Label (<=10 characters) .......... Test
Roughness correlation length (m) ....... 4000.
Surface roughness standard dev. (m) .... 1600.
Roughness power law index .............. 2.60
Slope power spectral density ........... 1.80
.
```

Scene Composition	Apr-Oct Fraction	Oct-Mar Fraction	CorLen (m)	St.Dev. (Log%)
Fresh Water	0.0000	0.0000	250.	-1.40
Sea Water	0.0000	0.0000	250.	-1.40
MODTRAN Ocean	0.0000	0.0000	250.	-1.40
GENESSIS Water Ocean	0.0000	0.0000	250.	-1.40
First Year Ice	0.0000	0.0000	250.	-1.40
Multi-Year Ice	0.0000	0.0000	250.	-1.40
Dry Snow	0.0000	0.0000	250.	-1.40
Wet Snow	0.0000	0.0000	250.	-1.40
MODTRAN Snow Cover (Fresh)	0.0000	0.0000	250.	-1.40
GENESSIS Fresh Snow (50 um radius)	0.0000	0.0000	250.	-1.40
GENESSIS Old Snow (1000 um radius)	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
MODTRAN Cloud Deck	0.0000	0.0000	250.	-1.40
Blackbody	0.0000	0.0000	250.	-1.40
Whitebody	0.0000	0.0000	250.	-1.40
Still Air	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Dry grass (Dry meadow fescue grass)	0.0000	0.0000	250.	-1.40
MODTRAN Grass	0.0000	0.0000	250.	-1.40
MODTRAN Dead Grass	0.0000	0.0000	250.	-1.40
MODTRAN Burnt Grass	0.0000	0.0000	250.	-1.40
Lawn grass (irrigated crops)	0.0000	0.0000	250.	-1.40
Scrub	0.3080	0.0500	250.	-1.40
Pine Tress (Mixed pine needles)	0.0000	0.0000	250.	-1.40
Broadleaf Trees (Summer)	0.0000	0.0000	250.	-1.40
Broadleaf Trees (Winter)	0.0000	0.0000	250.	-1.40
MODTRAN Forest	0.0000	0.0000	250.	-1.40
MODTRAN Farm	0.0000	0.0000	250.	-1.40
MODTRAN Maple Leaf	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Packed Soil (reddish clay loam)	0.1570	0.0000	250.	-1.40
Beach Sand (silica sand/silt loam)	0.0350	0.3500	250.	-1.40
Limestone-Silt-Sand	0.0000	0.0000	250.	-1.40
Limestone-Silt	0.0000	0.0000	250.	-1.40
Salt-Silt	0.0000	0.0000	250.	-1.40
Silt-Sand	0.0000	0.0000	250.	-1.40
Limestone Rock	0.0000	0.1000	250.	-1.40
Sandstone Rock (Red)	0.0000	0.0000	250.	-1.40

Varnished Sand	0.0000	0.0000	250.	-1.40
Varnished Sandstone	0.0000	0.0000	250.	-1.40
Dry Silt Playa	0.0000	0.0000	250.	-1.40
Wet Silt Playa	0.0000	0.0000	250.	-1.40
Dry Silt-Salt Flats	0.0000	0.0000	250.	-1.40
Wet Silt-Salt Flats	0.0000	0.0000	250.	-1.40
MODTRAN Desert	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Asphalt	0.0000	0.0000	250.	-1.40
Concrete	0.0000	0.0000	250.	-1.40
Building Roof (Galvanized Iron)	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
Undefined	0.0000	0.0000	250.	-1.40
User-defined	0.5000	0.5000	250.	-1.40
User-defined	0.0000	0.0000	250.	-1.40
User-defined	0.0000	0.0000	250.	-1.40

The Scene Label can be up to 10 characters and indicates the beginning of a user-defined scene. This label will appear in the ASCII output.

Next, the Scene Composition must be given. The first three (3) lines are headers and are ignored by MOSART. It is required to use the full template and enter the desired fraction for each material.

The Fraction of each material in the scene is defined for two (2) times of year, namely April to October and October to April. Also, the CorLen (correlation length, in m) of each material in the scene is required. The texture (i.e., the variability) for material, expressed as a logarithm (base 10) of the standard deviation (St.Dev. Log); this standard deviation is applied directly to the mean radiance.

4.7 User-Defined Aerosol File

It is recommended that the user use the aerosol data bases furnished with MOSART. This data base is taken directly from the extensive Mie calculation by Shettle and Fenn (1979) (see Technical Reference Manual). However, the user can calculate the scattering and absorption coefficients and the phase functions for a user-defined aerosol profile. It should be noted that such calculations are time consuming.

The template for the user-defined aerosol file is shown below and can be obtained by executing the CRFILE code.

```
User-defined Aerosol Parameters File (MOSART Version 1.00)
.
Number of Intervals ...................  100
Initial Radius (um) ....................  0.0001
Final Radius (um) .....................  100.00
.
Core & Coating Parameters
  Fraction of radius that is core ...... 0.00
  Fraction of Material No. 1 in core ... 0.00
  Type of Core Inclusion (MG/B /LL) .... MG
  Material No. 1 (W/I/O) .............. O
  Material No. 2 (W/I/O) .............. O
  Coating Material (W/I/O) ............ O
.
Particle Size Distribution Type ........ 1
1 Log Normal Size Distr. (Sig,R0) ...... 1.86  0.06951
2 Junge Size Distr. (Snu,R0) ........... 0.1  0.5
3 Hansen Size Distr. (Reff,Veff) ....... 0.5  .01
4 Mod. Gamma Size Distr. (Alp,Gamm,B) .. 6.0  0.5  1.897
5 Marshall-Palmer Rain Model (mm/hr) ... 0.0
6 Heymsfield Cirrus Cloud Model ........
7 User Size Distr. (Sdist(i),i=1,Nsd) .. 0.0
.
No. Wavelength    Matl. No. 1     Matl. No. 2     Coating
1      (um)       Real   Imag.    Real   Imag.    Real   Imag.
2      0.20       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
3      0.55       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
4      1.06       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
5     10.00       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
6    100.00       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
End of Spectral Data/
.
```

After the file's title (and "."), the Number of Intervals is the number of particle size bins into which the size interval is to be divided. The Initial Radius and Final Radius (in microns) specify the smallest and largest particle sizes, respectively, for the limits of integration.

MOSART calculates the aerosol properties for coated spheres. The Core is defined as having a Fraction of the total Radius, and can consist of one or two materials that are mixed together. The Fraction of Material No. 1 in core is specified. The combined optical properties are determined using a user-specified effective medium theory (EMT) for the Type of Core inclusion:

MG: Maxwell-Garnett
B: Brugge
LL: Lorentz-Lorens

More details are given in the MOSART Technical Reference Manual.

Both core materials (i.e., Material No. 1 and Material No. 2) and the Coating Material can be specified as:

W: Water
I: Ice
O: Other

If the other material is selected, its optical properties must be provided. The optical properties of both water and ice are calculated within the code.

The Particle Size Distribution Type is an index (1-7) for selecting an aerosol size distribution model. Six (6) models plus a user-defined model are available to specify the particle sizes. Once the user selects a model distribution, the appropriate statistical parameters must be provided. Parameters for the other distributions are ignored.

The parameters are as follows:

Log normal
- SIG: Standard deviation
- R0: Mean radius (μm)

Junge (or if R0 = 0.0, Power Law)
- SNU: Distribution parameter
- R0: Break point radius (μm)

Hansen
- REFF: Effective radius (μm)
- VEFF: Effective variance

Modified Gamma

$$f(r)dr = \frac{\gamma \beta^{(\alpha+1)\gamma}}{\Gamma\left(\frac{\alpha+1}{\gamma}\right)} r^{\alpha} e^{-\beta r^{\gamma}}$$

- ALP (α)
- GAMM (γ)
- B (β)

Marshall-Palmer Rain Model
- RRATE: Rain rate (mm/hr)

Heymsfield Cirrus Cloud Model (no input parameter)

User-defined
- SDIST: Size distribution
- NSD: Number of points

The spectral optical properties must be provided for any material specified as other (O). The two core materials and the coating material are specified separately. The inputs are the Real and Imaginary indices of refraction. If a material is water or ice, the spectral tabular data are ignored.

4.8 User-Defined Hydrometeor File

If a user decides not to use one of the several cloud profile and spectral data bases included in MOSART, a cloud can be defined. The template for the user-defined cloud, shown in Figure 8, can be obtained by executing the CRFILE code.

```
User-defined Hydrometer Parameters File (MOSART Version 1.0)
.
Cloud Base Altitude (km) ............... 5.0
Cloud Top Altitude (km) ................ 6.0
Visibility/LWC (km**-1 per gm/m**3) .... 0.783
Visibility/IC (km**-1 per gm/m**3) ..... 0.783
Rain Model (1 - 5) ..................... 1
Snow Crystal Type (1 - 6) .............. 1
.
```

After the file's title (and "."), the user specifies the Cloud Base Altitude and Cloud Top Altitude (in km). The Visibility/LWC and Visibility/IC are the extinction coefficients at 0.55 μm (visibility) in km^{-1} per gm/m^3 of liquid water content (LWC) and ice content (IC), respectively. Also, if precipitation is desired, the Rain Model (see Table 18) and Snow Crystal Types should be defined (see Section 4.2.5).

Table 18. Rain Models.

Index	Model
1	Marshall-Palmer General Rain
2	Joss and Waldvogel Drizzle
3	Joss and Waldvogel Widespread Rain
4	Joss and Waldvogel Thunderstorm
5	Sekhon and Srivastava Thunderstorm

```
--------------------------- Profile Parameters ---------------------------
No. Altitude    Liq. Water Content    Ice Content    Rain Rate    Snow Rate
     (km)           (gm/m**3)          (gm/m**3)      (mm/hr)      (mm/hr)
1    5.00             0.200              0.000          0.00         0.00
2    5.05             0.500              0.000          0.00         0.00
3    5.95             0.500              0.000          0.00         0.00
4    6.00             0.200              0.000          0.00         0.00
End of Profile Data/
.
```

For each Altitude, the Liquid Water and Ice Contents in gm/m^3, together with the Rain and/or Snow Rates in mm/hr, are defined.

```
--------------- Spectral Parameters (relative to 0.55 um) ---------------
               ------- Liquid Water -------  ----------- Ice ------------
No. Wavelength Scatter.  Absorp.  Asymmetry  Scatter.  Absorp.  Asymmetry
      (um)                         Factor                        Factor
1     0.20     1.0000    0.00000   0.9500    1.0000    0.00000   0.9500
2     0.55     0.9999    0.00001   0.7500    1.0000    0.00000   0.9500
3     1.00     0.5000    0.20000   0.6000    0.8000    0.00000   0.9500
4     3.00     0.0300    0.50000   0.5000    0.1000    0.00000   0.9500
5    10.00     0.0030    0.60000   0.2000    0.1000    0.00000   0.9500
6   100.00     0.0030    0.60000   0.2000    0.1000    0.00000   0.9500
End of Spectral Data/
.
```

The spectral data are normalized so that the extinction coefficient (scatter plus absorption) is unity at 0.55 µm. The inputs at other wavelengths are the normalized Scatter coefficient, the Absorption coefficient (km^{-1}), and the phase function Asymmetry Factor. These are given for both water and ice. **NOTE: An entry is required for each column.**

5.0 MOSART OUTPUT FILES

MOSART has options to produce a number of different output files, namely:

- ASCII Summary File,
- Atmospheric Binary File,
- Background Binary File,
- Plume Binary File,
- Multiple Scattering Binary File,
- Heat Transfer Binary File,
- Transmittance Binary File,
- TAPE7 (similar to MODTRAN TAPE7),
- TAPE8 (similar to MODTRAN TAPE8).

Each is described below.

5.1 ASCII Summary File (xxxxxx.out)

The ASCII Summary File provides the user with in-band values of the environmental parameters, after having the calculations degraded to the specified resolution and being convolved with the user-specified filter responses. Also, atmospheric profiles, terrain parameters, source conditions, and a summary of the input parameters are provided. There are ten (10) sections to this output, which are included or omitted based upon the user's selection of Short, Medium, or Long output:

	Short	Medium	Long
Atmospheric Profile No. 1			x
Atmospheric Profile No. 2			x
Atmospheric Profile No. 3			x
Earth Background Summary	x	x	x
Input Summary			x
Basic Radiative Environment	x	x	x
Earth/Skyshine Summary		x	x
Source Atmospheric Conditions			x
Background Material Summary			x
Background Radiative Environment		x	x

The Atmospheric Profile sections are found at the beginning of the file. In Profile No. 1, the pressure, temperature, relative humidity, the structure constant, and the structure length are given as a function of altitude. The parameters for Profile No. 2 include aerosol type, aerosol extinction coefficient, cloud water and ice densities and type, and rain and snow precipitation rates. The names of the aerosol types are abbreviated but should be clear. The cloud types use standard World Meteorological Organization abbreviations (see Table 19). Profile No. 3 includes the molecular concentration profiles for thirteen (13) molecular species. The concentrations, as delivered, are given in ppmv. However, by using the commented out sections of SUBROUTINE EQUABS, it is possible to have the concentrations in atm-cm/km or in cm^3. MOSART allows the boundaries between atmospheric regions to vary in accordance with the profile. Thus, the locations of the ground level, boundary layer, tropopause, stratopause, and mesopause are provided in both profiles.

Table 19. World Meteorological Organization Cloud Abbreviations.

Cirrus	Ci
Cirrocumulus	Cc
Cirrostratus	Cs
Altocumulus	Ac
Altostratus	As
Nimbostratus	Ns
Stratocumulus	Sc
Stratus	St
Cumulus	Cu
Cumulonimbus	Cb
Ref: International Cloud Atlas. Manual on the Observation of Clouds and Other Meteors. World Meteorological Organization. WMO No. 407 (1975).	

The Earth Background Summary provides material temperatures (for each model atmosphere, if a global atmosphere is selected) for sunlit and shade.

The Input Summary, normally two (2) pages, summarizes the input conditions.

The other sections, a sample of which is shown in Appendix A, provide a variety of in-band values.

5.2 Binary File Format

All the MOSART binary files share a common format. This format consists of a user-supplied heading, a title, a header block of parameters, and then a set of spectral records. Each MOSART binary file is a sequential access, unformatted file.

The first record in each MOSART binary file consists of:

(1) a 40-character user-supplied heading (HEADNG); and
(2) an 80-character MOSART title, which includes the time and date of generation (TITLE).

The second record in each MOSART binary file consists of a header block of non-spectral parameters in the following format:

(1) Number of REAL variables in a spectral record (NVAR) for each geometry;
(2) Number of INTEGER variables in the header (NHDR(1));
(3) Number of REAL variables in the header (NHDR(2));
(4) Number of geometries (NGEOM);
(5) Number of spectral intervals (NVSET);
(6) Number of spectral records in each interval (NV(1) to NV(20));
(7) File identification (IFILE) (see Table 20);
(8) Set of NHDR(1) minus (4 + NVSMAX) INTEGER parameters, where NVSMAX is the maximum number of spectral intervals; and
(9) Set of NHDR(2) REAL parameters.

The contents of each file header are discussed below.

Following the header are a set of spectral records, grouped as follows:

(1) Each spectral interval is a contiguous, separate set of spectral records;
(2) Within each spectral interval set, there is a set of records for each spectral value; and
(3) For each spectral value, there is a record for each geometry.

Table 20. MOSART Binary Files.

FILE SUFFIX	IFILE	HEADER
.atm	1	Basic only
.bck	2	Basic plus altitude parameters
.plm	3	Basic only
.msc	4	Basic plus altitude parameters
.htr	5	Basic only
.trn	6	Basic only

Each spectral geometry record has the following format:

(1) The first variable (INTEGER) is the geometry number (IGEOM);
(2) The second variable (REAL) is the wavenumber in cm^{-1} (V);
(3) The third variable (REAL) is the wavenumber increment in cm^{-1} (DV); and
(4) The remaining NVAR-2 REAL variables are the spectral parameters which are described for each file.

5.2.1 Basic Header Contents

Each binary file header consists of a basic set of INTEGER and REAL variables, plus additional variables that are specific to each file (see Table 20). The basic header contents are:

The INTEGER Variables

NGEOM	Number of geometries
NVSET	Number of spectral sets
NV(NVSMAX)	Number of spectral points/set
IFILE	Binary file index
NLAT	Number of latitudes
NLON	Number of longitudes
MA(MAXLAT, MAXLON)	Model atmosphere index
MP(MAXLAT, MAXLON)	Model pressure index
MT(MAXLAT, MAXLON)	Model temperature index
MC(ISMX,MAXLAT, MAXLON)	Model molecular concentrations index
IAERO1(MAXLAT, MAXLON)	Boundary layer aerosol index
IAERO2	Stratospheric aerosol index
IHAZE	Haze profile index
IUPPER	Upper atmosphere haze index

ICSTL(MAXLAT, MAXLON)	Air mass character index
IVSA	Vertical structure algorithm index
ISEASN	Season index
IEPHEM	Ephemeris index
ISOLAR	Solar switch
ISMPLS	Simple/complex solar calculation switch
ILUNAR	Lunar switch
ISMPLL	Simple/complex lunar calculation switch
IDAY	Day of the month
IMONTH	Month of the year
IYEAR	Year
ITIME	Time index
ICLDRN	Cloud/fog/rain/snow index
ICLOUD	Cloud index
ICIRUS	Cirrus index
IICE	Ice index
IRAIN	Rain index
ISNOW	Snow index
IBKGD	Background index
NAZ(NGMAX)	Number of observer-source azimuths
MAZ	Temporary storage for NAZ(NGMAX)
NASPCT(NGMAX)	Number of earth/skyshine elevation angles
IAZSH	Earth/skyshine index
NAZSH	Number of earth/skyshine azimuth angles
ITERM(NGMAX)	Observer-source path background index
JTERM(NAZMAX,NGMAX)	Observer-source path background index for each azimuth
KTERM(NASMAX, NZSMAX,NGMAX)	Earth/skyshine path background index
IDV(NVSMAX)	Spectral calculation index
ICOREF	Coordinate reference switch
IHTBLC	Background temperature switch
ISPCAL	Spectral calculation index
IMLSCT	Multiple scattering switch
IFBSW	Fore/background switch
IAZREF	Azimuth reference switch
ISLANG	Elevation/zenith angle switch
IANGSW(NGMAX)	Angle switch
IGMSW(NGMAX)	Geometry switch
ITPGM(NGMAX)	Geometry type index
IPAND(10)	Expansion positions for growth

The REAL Variables

VIS(MAXLAT,MAXLON)	Sea level meteorological range (km)
HOBS(NGMAX)	Observer altitude (km)
PHIOBS(NGMAX)	Observer elevation angle (deg)
HSRC(NGMAX)	Source altitude (km)
PHISRC(NGMAX)	Source elevation angle (deg)
HBCK	Background altitude (km)
PHIBCK(NGMAX)	Background elevation angle (deg)
SLROS(NGMAX)	Observer-source slant range (km)
BETAOS(NGMAX)	Observer-source earth center angle (deg)
SLROB(NGMAX)	Observer-background slant range (km)
BETAOB(NGMAX)	Observer-background earth center angle (deg)
HTANG(NGMAX)	Tangent altitude (km)
SOLEV	Solar elevation (deg)
SOLAZ	Solar azimuth (deg)
SOLDIS	Normalized solar distance
XLUNEV	Lunar elevation (deg)
XLUNAZ	Lunar azimuth (deg)
PHLUNR	Lunar phase (deg)
XLNDIS	Normalized lunar distance
AZIM(NAZMAX)	Observer/source azimuth (deg)
AZIML(NGMAX)	Azimuth if other latitude and longitude are defined (deg)
HOUR	Solar time (LST) (hour)
PHISH(NASMAX,NGMAX)	Earth/skyshine elevation angles (deg)
TAIR(MAXLAT,MAXLON)	Surface air temperature (K)
V1(NVSMAX)	Initial wavenumber (cm^{-1})
V2(NVSMAX)	Final wavenumber (cm^{-1})
DVI(NVSMAX)	Calculation increment (cm^{-1})
DWL(NVSMAX)	Calculation increment (μm)
PSRC(NGMAX,NAZMAX)	Source pressure (mb)
TSRC(NGMAX,NAZMAX)	Source temperature (K)
CSRC(7,NGMAX,NAZMAX)	Source molecular concentrations (ppmv)
HCIRBS	Cirrus base altitude (km)
DELCIR	Cirrus thickness (km)
ZINVSA	Inversion altitude (km)
WHH	24-hour mean wind speed (m/sec)
WIND(MAXLAT,MAXLON)	Local wind speed (m/sec)
WINDHI	Average stratospheric wind speed (m/sec)
XLAT(2,NGMAX)	Latitude of observer and source (deg)
XLONG(2,NGMAX)	Longitude of observer and source (deg)

TIME	Time of the day
TINF(MAXLAT,MAXLON)	Exospheric temperature
AZSH(NZSMAX)	Earth/skyshine azimuths (deg)
CLDCVR(0:3,MAXLAT, MAXLON)	Total/low/mid/high cloud cover (%)
HPRF(2)	Initial and final altitudes for profile (km)
APERT	Observer aperture diameter (m)
FOR	Observer field of regard (mrad)
CIREXT	Cirrus extinction coefficient at 0.55 μm (km^{-1})
CIRICE	Cirrus ice content (gm/m^3)
ULWSRC(NAZMAX,NGMAX)	Upward long-wave flux at source (W/m^2)
DLWSRC(NAZMAX,NGMAX)	Downward long-wave flux at source (W/m^2)
USWSRC(NAZMAX,NGMAX)	Upward short-wave flux at source (W/m^2)
DSWSRC(NAZMAX,NGMAX)	Downward short-wave flux at source (W/m^2)
BSWSRC(NAZMAX,NGMAX)	Beam short-wave flux at source (W/m^2)
CLALTB(3,MAXLAT,MAXLON)	Low/mid/high etage cloud base altitude (km)
CLALTT(3,MAXLAT, MAXLON)	Low/mid/high etage cloud top altitude (km)
CN2SRF	Structure constant at surface ($m^{-2/3}$)
XLATSL	Solar latitude (deg)
XLONSL	Solar longitude (deg)
XLATLN	Lunar latitude (deg)
XLONLN	Lunar longitude (deg)
XPAND(10)	Expansion positions for growth

where MOLMAX = 26,
ISMX = MOLMAX + 8,
MAXLAT = 3,
MAXLON = 1,
NASMAX = 15,
NAZMAX = 30,
NGMAX = 15,
NVSMAX = 20, and
NZSMAX = 4.

5.2.2 Atmosphere Binary File (xxxxxx.atm)

The ".atm" file contains the basic atmospheric parameters. For this file, IFILE = 1, and the header consists only of the basic parameters. The spectral variables are:

For each observer azimuth

Transmittance to source
Scintillation to source
Forward-scattered transmittance from source
Emitted observer-source path radiance $(W/cm^2/sr/cm^{-1})$
*Apparent solar irradiance at source $(W/cm^2/cm^{-1})$
*Apparent lunar irradiance at source $(W/cm^2/cm^{-1})$
Transmittance to background
Scintillation of background
Forward-scattered transmittance from background
Emitted observer-background path radiance $(W/cm^2/sr/cm^{-1})$
*Standard deviation of apparent observer-source path radiance $(W/cm^2/sr/cm^{-1})$
*Standard deviation of apparent observer-background path radiance $(W/cm^2/sr/cm^{-1})$
*Apparent scattered observer-source path radiance $(W/cm^2/sr/cm^{-1})$
*Apparent scattered observer-background path radiance $(W/cm^2/sr/cm^{-1})$
*Apparent emitted background radiance $(W/cm^2/sr/cm^{-1})$
*Apparent reflected background radiance $(W/cm^2/sr/cm^{-1})$
*Standard deviation of apparent background radiance $(W/cm^2/sr/cm^{-1})$

For each earth/skyshine aspect and azimuth

Transmittance from observer to source then along earth/skyshine line-of-sight
*Apparent emitted path radiance along earth/skyshine line-of-sight $(W/cm^2/sr/cm^{-1})$
*Apparent emitted background radiance for earth/skyshine line-of-sight $(W/cm^2/sr/cm^{-1})$
*Apparent reflected background radiance for earth/skyshine line-of-sight $(W/cm^2/sr/cm^{-1})$
*Apparent scattered path radiance along earth/skyshine line-of-sight $(W/cm^2/sr/cm^{-1})$

*Note: All apparent values include transmittance

5.2.3 Background Binary File (xxxxxx.bck)

The ".bck" file contains altitude dependent atmospheric parameters. For this file, IFILE = 2, and the header consists of the basic parameters, plus the following:

INTEGER Variables

NBCKZ — Number of altitudes

Real Variables

For each altitude:

ZBCK — Altitude (km)

For each geometry:

SWBCK
**TBCK — Temperature (K)

** For the global atmosphere option, three (3) values are given per altitude.

The spectral values are:

For each altitude and observer azimuth:

Transmittance from observer to specified altitude
Scintillation of an object at the specified altitude
Forward-scattered transmittance from the specified altitude
Emitted path radiance between the observer and the specified altitude ($W/cm^2/sr/cm^{-1}$)
Standard deviation of the path radiance between the observer and the specified altitude ($W/cm^2/sr/cm^{-1}$)
*Apparent solar irradiance at the observed altitude ($W/cm^2/cm^{-1}$)
*Apparent lunar irradiance at the observed altitude ($W/cm^2/cm^{-1}$)
Scattered path radiance between the observer and the specified altitude ($W/cm^2/sr/cm^{-1}$)
*Apparent emitted upper hemisphere skyshine at the specified altitude ($W/cm^2/cm^{-1}$)
*Apparent scattered upper hemisphere skyshine at the specified altitude ($W/cm^2/cm^{-1}$)

* Note: All apparent values include transmittance

5.2.4 Plume Binary File (xxxxxx.plm)

The ".plm" file contains the atmospheric parameters required by plume signature codes, such as SIRRM. For this file, IFILE = 3, and the header consists only of the basic parameters. The spectral values are:

For each observer azimuth:

Transmittance between the observer and the source
Emitted path radiance between the observer and the source ($W/cm^2/sr/cm^{-1}$)
Second integral of RR for scattering

For each plume molecular species (i.e., H_2O, CO_2, O_3, N_2O, CO, and CH_4) and for each line group:

Beer's Law optical depth
Curtis-Godson summation of Lorentz line width
Curtis-Godson summation of Doppler line width
Natural logarithm of component transmittance
Atmospheric component transmission

and the following:

Aerosol optical depth
Aerosol absorption optical depth
Carbon dioxide continuum optical depth
Water vapor continuum optical depth

5.2.5 Multiple Scattering Binary File (xxxxxx.msc)

The ".msc" file contains the exponential sum fitting parameter used by various multiple scattering codes. For this file, IFILE = 4. The header consists of the basic parameters, plus the following:

INTEGER Variables

MLO	Number of altitudes

REAL Variables

For each altitude:

ZL Altitude (km)

The spectral parameters are:

For each altitude:

Number of terms in exponential sum fit (REAL variable to maintain binary file format)

For each term in the exponential sum fit expansion:

**Linear weight
**Exponential Coefficient

and the following:

**Aerosol/hydrometeor asymmetry parameter
**Aerosol/hydrometeor extinction coefficient (km^{-1})
**Aerosol/hydrometeor albedo
**Molecular albedo

** For the global atmosphere, three (3) values are given per altitude and per term.

5.2.6 Heat Transfer Binary File (xxxxxx.htr)

The ".htr" file contains the broad-based heat transfer parameters as a function of the time of day. Unlike the other binary files, this file contains temporal, not spectral, parameters. For this file, IFILE = 5, and the header consists only of the basic parameters.

Since this file contains temporal data, NGEOM = 1, NVSET = 1, and NV(1) = NTIME = 97. Each temporal record consists of:

(1) a dummy INTEGER variable for compatibility with the binary file format;
(2) decimal time (24-hour clock); with NTIME = 97, the time should start at midnight (0.00 hours) and continue in 15 minute increments to the next midnight (24.00 hours).

The remaining REAL temporal records are:

SOLEV	Solar elevation (deg)
SOLAZ	Solar azimuth (deg)

For each of 10 altitudes:

ZLYR	Altitude (km)
TLYR	Temperature (K)
BSW	Beam (direct) short-wave (0.40 - 2.5 μm) irradiance (W/m^2)
USW	Upward diffuse short-wave irradiance (W/m^2)
DSW	Downward diffuse short-wave irradiance (W/m^2)
ULW	Upward diffuse long-wave (2.5 - 25.0 μm) irradiance (W/m^2)
DLW	Downward diffuse long-wave irradiance (W/m^2)

5.2.7 Transmittance Binary File (xxxxxx.trn)

The ".trn" file contains transmittance values for each atmospheric component. For this file, IFILE = 6, and the header consists only of the basic parameters. The spectral parameters are:

For each observer azimuth:

Total observer-source transmittance component transmittances for:

- Water vapor band line wings (continuum)
- Carbon dioxide band and line wings
- Ozone band and line wings
- Nitrous oxide band and line wings
- Carbon monoxide band and line wings
- Methane band and line wings
- Oxygen band and line wings
- Nitric oxide band and line wings
- Sulfur dioxide band and line wings
- Nitrogen dioxide band and line wings
- Ammonia band and line wings
- Nitric acid band and line wings
- Nitrogen band and continuum
- Molecular scattering

- Aerosol absorption and scattering
- Water cloud absorption and scattering
- Ice cloud absorption and scattering
- Rain absorption and scattering
- Snow absorption and scattering
- Dummy absorption and scattering
- Cirrus absorption and scattering

The band and line wing (or continuum) absorption and the scattering and absorption terms are provided separately.

5.3 Optional ASCII Output Files

There are two (2) optional ASCII output files that correspond to the MODTRAN TAPE7 and TAPE8 files. The MOSART files are not exact copies of these two files, but are typically labelled with the suffixes ".tp7" and ".tp8" (or ".tape7" and ".tape8"), as they are analogous to the MODTRAN files.

The two files have a common header format. The first two lines consist of the user-supplied heading and the title with the creation date. The contents of the header (see Section 5.2.1) are printed out. The format depends upon the number of spectral intervals, the number of observer azimuths, specified versus global atmosphere, and number of geometries. For the exact format, the user should refer to SUBROUTINE PRTHDR, which prints the information to the file.

The spectral record format for each is shown in Tables 21 and 22. A spectral record is presented for each observer azimuth.

The Uniformly Mixed Gases consist of

- CO_2
- N_2O
- CO
- CH_4
- O_2

The Trace Gases consist of

- NO
- SO_2
- NO_2
- NH_3

Table 21. TAPE7 Spectral Parameters.

Geometry Number (*)	Wavenumber (cm^{-1}) (*)	Transmittance Observer to Source	Log of Transmittance Obs/Source	Apparent Solar Irr. at Observer	Emitted Obs./Source Path Radiance	Scattered Obs/Source Path Radiance	Emitt Scatt. Obs./Source Path Radiance
-	-	Transmittance Observer to Background	Log of Transmittance Obs/Bck	Apparent Solar Irr. at Background	Emitted Obs/Bck. Path Radiance	Scattered Obs/Bck Path Radiance	Emitt & Scatt. Path and Emitt. & Reflec. Background Radiance
-	-	Transmittance Observer to Source to Sun	-	Emitted Obs/Source Path Radiance	Scattered Obs/Source Path Radiance	Emitted Background Radiance	Reflected Background Radiance
-	-	Transmittance Observer to Background to Sun	-	Emitted Obs/Bck Path Radiance	Scattered Obs/Bck Path Radiance	Exoatmospheric Solar Irradiance	-

* Only for first azimuth and atmosphere

All units are $W/cm^2/sr/cm^{-1}$ for radiance and $W/cm^2/cm^{-1}$ for irradiance

Table 22. TAPE8 Spectral Parameters.

Geometry Number (*)	Wavenumber (cm^{-1}) (*)	Transmittance Observer to Source	Transmittance Obs/Src H_2O	Transmittance Obs/Src CO_2	Transmittance Obs/Src O_3	Transmittance Obs/Src N_2O	Transmittance Obs/Src CO
-	-	Log of Transmittance Obs/Src	Transmittance Obs/Src CH_4	Transmittance Obs/Src O_2	Transmittance Obs/Src NO	Transmittance Obs/Src SO_2	Transmittance Obs/Src NO_2
-	-	Emit + Scatt Obs/Src Path Radiance ($W/cm^2/sr/cm^{-1}$)	Transmittance Obs/Src NH_3	Transmittance Obs/Src HNO_3	Transmittance Obs/Src Mol. Scatt	Transmittance Obs/Src Aerosol Sc.	Transmittance Obs/Src Aerosol Ab.
-	-	Transmittance Obs/Src Uniformly Mixed Gases	Transmittance Obs/Src Trace Gases	Transmittance Obs/Src Nz	Transmittance Obs/Src Hydromet. Scatt.	Transmittance Obs/Src Hydromet. Abs.	Transmittance Obs/Src H_2O Continuum
-	-	Transmittance Obs/Src O_2 Continuum	-	-	-	-	-

* Only for first azimuth and atmosphere

- HNO_3
- N_2

The Hydrometeors consist of

- Water Clouds
- Ice Clouds
- Cirrus
- Rain
- Snow

6.0 UTILITY PROGRAMS

A number of utility programs are provided with MOSART. Each utility program is discussed briefly below. These utilities include:

- CRFILE: File Creation
- PLTGEN: Plot Generation
- BBTEMP: Blackbody Temperature
- VISUAL: Visual
- MRFLTR: Filter Integration
- ASCBIN: ASCII-Binary Conversion

6.1 File Creation (CRFILE) Utility

CRFILE allows the user to create interactively a MOSART input file or to produce templates for all the user-defined input files. It provides the user with an on-line access to the menus for developing a MOSART input file. It can also transform a standard MODTRAN input file (i.e., TAPE5) to a MOSART input file. To run CRFILE, simply execute the code, which will prompt for the file root name. The file root that will be used to create the various input files with the same suffixes used by MOSART (see Installation Reference Manual for customizing suffixes). A menu is then provided:

```
Select type of work desired -

    0 - Terminate job execution
    1 - Create a MOSART input file
    2 - Create a filter response file
    3 - Create a background definition file
    4 - Create an atmosphere definition file
    5 - Create a hydrometeor definition file
    6 - Create an aerosol definition file
    7 - Display the menus
    8 - Transform MODTRAN ---> MOSART input file
```

If a MOSART input file is to be created, CRFILE will prompt the user for all desired inputs. The only tabular input that is prompted for interactively is the Geometry Specifications. The geometry values are continually cycled until the user responds that no more geometries are to be input. For the Antecedent Specifications and the User-supplied Atmosphere tabular values, CRFILE will provide a template (if requested), which can then be edited by the user to insert the desired values.

On-screen assistance is available. If you desire assistance for a particular prompt, a response of "?" provides the assistance, if possible.

NOTE: A MOSART Graphical User Interface (GUI) is available to assist in constructing MOSART input files. It requires X-windows and MOTIF.

You will be prompted for all the inputs for the required sections. Once the required sections have been obtained, you will be asked if you wish any of the optional sections. If you do, you will be shown the title of each section and prompted if you wish to include it, in which case you will be prompted for each input for the section.

CRFILE provides other files (i.e., filter response, background definition, atmosphere definition, hydrometeor definition, and aerosol definition) only in template form (see Figures 5 through 9). These are then manipulated with an editor to insert the desired values.

For the filter response, you can either create a template with the human eye photopic response or convert a MODTRAN filter file.

If the Menu option is selected (as opposed to requesting help during creation of a MOSART input file), the following menu is provided:

```
Select information desired:

   0 - Return to main menu
   1 - Atmosphere models
   2 - Tropospheric aerosol models
   3 - Stratospheric aerosol models
   4 - Haze altitude profiles
   5 - Cloud models
   6 - Cloud/rain/snow models
   7 - Rain models
   8 - Snow models
   9 - Background types
  10 - Terrain types
  11 - Month of year
  12 - Seasons
  13 - Mesospheric haze profiles
```

The user can cycle through the menu as desired.

To assist users who have MODTRAN files, a transform capability is provided to convert standard MODTRAN TAPE5 files into equivalent MOSART input files. Since MOSART requires some additional information, additional prompts are given. Also, there are presently several limitations on the type of MODTRAN files that can be converted:

```
Filter Response Spectral Parameters File (Ver. 1.00)
.
Filter Name (<=24 characters) .......... Photopic Resp.
.
Parameters:    Wavelength (um)         Normalized Response
1                  0.370                    0.00000
2                  0.380                    0.00004
3                  0.390                    0.00012
4                  0.400                    0.0004
5                  0.410                    0.0012
6                  0.420                    0.0040
7                  0.430                    0.0116
8                  0.440                    0.0230
9                  0.450                    0.0380
10                 0.460                    0.0600
11                 0.470                    0.0910
12                 0.480                    0.1390
13                 0.490                    0.2080
14                 0.500                    0.3230
15                 0.510                    0.5030
16                 0.520                    0.7100
17                 0.530                    0.8620
18                 0.540                    0.9540
19                 0.550                    0.9950
20                 0.555                    1.0000
21                 0.560                    0.9950
22                 0.570                    0.9520
23                 0.580                    0.8700
24                 0.590                    0.7570
25                 0.600                    0.6310
26                 0.610                    0.5030
27                 0.620                    0.3810
28                 0.630                    0.2650
29                 0.640                    0.1750
30                 0.650                    0.1070
31                 0.660                    0.0610
32                 0.670                    0.0320
33                 0.680                    0.0170
34                 0.690                    0.0082
35                 0.700                    0.0041
36                 0.710                    0.0021
37                 0.720                    0.00105
38                 0.730                    0.00052
39                 0.740                    0.00025
40                 0.750                    0.00012
41                 0.760                    0.00006
42                 0.770                    0.00000
End of Spectral Data/
.
```

Figure 5. Sample Filter Response File.

```
User-defined Background Material/Scene File (Version 1.00)
.
Number of background materials (<=3) ... 3
Labels (<=10 characters) (No. 1) ...... Example 1
Labels (<=10 characters) (No. 2) ...... Example 2
Labels (<=10 characters) (No. 3) ...... Example 3
.
Background type (0,1,2) ............... 0       0       0
Fractional diffuse component .......... 1.00    1.00    1.00
Roughness standard deviation (m) ...... 0.00    0.00    0.00
Roughness correlation length (m) ...... 0.00    0.00    0.00
Roughness correlation type (1,2) ...... 0       0       0
Fraction of air included .............. 0.00    0.00    0.00
Type of inclusion (1,2) ............... 0       0       0
Heat transfer flag (0,1,2,3) .......... 0       0       0
Solar absorptivity .................... 0.80    0.20    0.50
Thermal emissivity .................... 0.98    0.98    0.98
Conduction coefficient (w/m**2/K) ..... 0.10    0.10    0.10
Convection coefficient (w/m**2/K) ..... 0.10    0.10    0.10
Specific heat (w-sec/gm/K) ............ 1.00    1.00    1.00
Density (gm/m**3) ..................... 1.00    1.00    1.00
.
No. Wavelength (um) and aver. reflectance for each material
1      0.2       0.55     0.70     1.00
2      2.0      .65    0.70     1.00
3     20.0       0.75     0.70     0.90
4    200.0       0.85     0.70     0.95
End of Spectral Data/
.
Hour (24-hour dec. format) and delta-T (K) for each material
1      0.0          -1.0     -1.2     -1.4
2      6.0          -1.0     -1.5     -1.3
3     12.0           5.0      8.0      2.0
4     18.0           2.0      3.0      0.5
5     24.0          -1.0     -1.2     -1.4
End of Temporal Data/
.
Scene Label (<=10 characters) ........ Dummy
Roughness correlation length (m) ...... 4000.
Surface roughness standard dev. (m) .... 1600.
Roughness power law index ............. 2.60
Slope power spectral density .......... 1.80
.
Scene Composition                        Apr-Oct  Oct-Mar
                                         Fraction Fraction CorLen St.Dev.
                                                            (m)   (Log)
  Fresh Water ........................ 0.5000   0.0000    250.  -1.40
  Sea Water .......................... 0.0100   0.0000    250.  -1.40
  First Year Ice ..................... 0.0100   0.0010    250.  -1.40
  Multi-Year Ice ..................... 0.0100   0.0010    250.  -1.40
  Dry Snow ........................... 0.0100   0.0010    250.  -1.40
  Wet Snow ........................... 0.0100   0.0010    250.  -1.40
  Blackbody .......................... 0.0000   0.0010    250.  -1.40
  Whitebody .......................... 0.0100   0.0010    250.  -1.40
  Grass/Meadow ....................... 0.0100   0.0010    250.  -1.40
  Irrigated Vegetation ............... 0.0100   0.0010    250.  -1.40
  Scrub .............................. 0.0100   0.0010    250.  -1.40
  Pine Trees ......................... 0.0100   0.0010    250.  -1.40
  Broadleaf Trees (Summer) ........... 0.0100   0.0010    250.  -1.40
  Broadleaf Trees (Winter) ........... 0.0100   0.0010    250.  -1.40
  Undefined .......................... 0.0100   0.0010    250.  -1.40
  Undefined .......................... 0.0100   0.0010    250.  -1.40
  Packed Soil/Dirt ................... 0.0100   0.0000    250.  -1.40
  Sand ............................... 0.0100   0.0010    250.  -1.40
  Rock ............................... 0.0100   0.0010    250.  -1.40
  Undefined .......................... 0.0000   0.8000    250.  -1.40
  Asphalt ............................ 0.0000   0.0300    250.  -1.40
  Concrete ........................... 0.0000   0.0300    250.  -1.40
  Building Roof (Galvanized Iron) ..... 0.0100   0.0010    250.  -1.40
  Undefined .......................... 0.0100   0.0010    250.  -1.40
  Undefined .......................... 0.0100   0.0010    250.  -1.40
User-defined No. 1 ................... 0.0100   0.0010    250.  -1.40
User-defined No. 2 ................... 0.0100   0.0010    250.  -1.40
User-defined No. 3 ................... 0.0100   0.0010    250.  -1.40
.
```

Figure 6. User-Defined Background Material/Scene File.

```
User-defined Atmospheric Parameters File (MOSART Version 1.00)
.
Radius of  the earth (km) ............
Profiles:
No. Alt.   Press.   Temp. Dens.    H2O CO2   O3 N2O   CO CH4   O2  Aer. Haze   Cn2
  (km)
Switch:        0      0     0        0   0    0   0    0   0    0     0   0      0
1   0.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
2   1.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
3   2.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
4   3.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
5   4.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
6   5.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
7   6.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
8   7.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
9   8.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
10  9.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
11 10.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
12 11.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
13 12.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
14 13.0    0.0    0.0   0.0     0.0 0.0 0.0 0.0 0.0 0.0 0.0     0 0.0    0.0
End of Profile Data/
.
```

Figure 7. User-Defined Atmospheric Parameters File.

```
User-defined Hydrometer Parameters File (MOSART Ver. 1.00)
.
Cloud Base Altitude (km) ............... 5.0
Cloud Top Altitude (km) ................ 6.0
Visibility/LWC (km**-1 per gm/m**3) .... 0.783
Visibility/IC (km**-1 per gm/m**3) ..... 0.783
Rain Model (1 - 5) ..................... 1
Snow Crystal Type (1 - 6) .............. 1
.
--------------------------- Profile Parameters ---------------------------
No. Altitude   Liq. Water Content    Ice Content    Rain Rate    Snow Rate
      (km)        (gm/m**3)           (gm/m**3)      (mm/hr)      (mm/hr)
1     5.00          0.200               0.000          0.00         0.00
2     5.05          0.500               0.000          0.00         0.00
3     5.95          0.500               0.000          0.00         0.00
4     6.00          0.200               0.000          0.00         0.00
End of Profile Data/
.
----------------- Spectral Parameters (relative to 0.55 um) -----------------
               -------- Liquid Water --------   ------------ Ice -------------
No. Wavelength  Scatter.   Absorp.  Asymmetry   Scatter.   Absorp.  Asymmetry
       (um)     (km**-1)  (km**-1)    Factor    (km**-1)  (km**-1)    Factor
1      0.20       1.0000   0.00000    0.9500      1.0000   0.00000    0.9500
2      0.55       0.9999   0.00001    0.7500      1.0000   0.00000    0.9500
3      1.00       0.5000   0.20000    0.6000      0.8000   0.00000    0.9500
4      3.00       0.0300   0.50000    0.5000      0.1000   0.00000    0.9500
5     10.00       0.0030   0.60000    0.2000      0.1000   0.00000    0.9500
6    100.00       0.0030   0.60000    0.2000      0.1000   0.00000    0.9500
End of Spectral Data/
.
```

Figure 8. Sample User-Defined Hydrometeor Parameters File.

```
User-defined Aerosol Parameters File (MOSART Version 1.00)
.
Number of Intervals ...................  100
Initial Radius (um) ....................  0.0001
Final Radius (um) .....................  100.00
.
Core & Coating Parameters
  Fraction of radius that is core ...... 0.00
  Fraction of Material No. 1 in core ... 0.00
  Type of Core Inclusion (MG/B /LL) .... MG
  Material No. 1 (W/I/O) ............... O
  Material No. 2 (W/I/O) ............... O
  Coating Material (W/I/O) ............. O
.
Particle Size Distribution Type ........ 1
1 Log Normal Size Distr. (Sig,R0) ...... 1.86  0.06951
2 Junge Size Distr. (Snu,R0) ........... 0.1  0.5
3 Hansen Size Distr. (Reff,Veff) ....... 0.5  .01
4 Mod. Gamma Size Distr. (Alp,Gamm,B) .. 6.0  0.5  1.897
5 Marshall-Palmer Rain Model (mm/hr) ... 0.0
6 Heymsfield Cirrus Cloud Model ........
7 User Size Distr. (Sdist(i),i=1,Nsd) .. 0.0
.
No. Wavelength    Matl. No. 1     Matl. No. 2     Coating
1      (um)       Real   Imag.    Real   Imag.    Real   Imag.
2      0.20       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
3      0.55       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
4      1.06       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
5     10.00       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
6    100.00       1.441  1.03E-8 1.441  1.03E-8 1.441  1.03E-8
End of Spectral Data/
.
```

Figure 9. Sample User-Defined Aerosol Parameters File.

- Since MOSART is not currently designed to cycle on the atmospheric characterization, only the first definition of atmospheric properties is accepted;
- Only the first fifteen (15) line-of-sight geometries are accepted for use in the MOSART input file due to dimension limits; this can be overcome by increasing NGMAX in MOSART;
- Only the first twenty (20) spectral bands are accepted for use in the MOSART input file due to dimension limits; this can be overcome by increasing NVSMAX in MOSART;
- Lines 2D1 and 2D3 (user-defined aerosols) are not presently translated;
- NOPRT is used to select Small versus Large output;
- ISEASN (for haze) must agree with MODEL; otherwise, the value consistent with MODEL is used;
- TBOUND, SALB, RAINRT, and RO are not converted at present;
- ISEED is ignored since MOSART does not contain the NOAA random cirrus cloud model; and
- ZCVSA and ZTVSA are not converted at this time, since MOSART obtains these values from the hydrometeor models.

6.2 Plot Generator (PLTGEN) Utility

PLTGEN, as delivered, will provide numerous plots using the NCAR plotting software. Some examples of these plots are:

- Observer-Source Path Radiance vs. Wavelength/Wavenumber (linear scale) (Figure 10)
- Observer-Source Path Radiance vs. Wavelength/Wavenumber (logarithmic scale) (Figure 11)
- Background Radiance vs. Wavelength/Wavenumber (linear scale) (Figure 12)
- Background Radiance vs. Wavelength/Wavenumber (logarithmic scale) (Figure 13)
- Observer-Source Transmittance vs. Wavelength/Wavenumber (linear scale) (Figure 14)
- Observer-Source Transmittance vs. Wavelength/Wavenumber (logarithmic scale) (Figure 15)

PLTGEN expects to be able to read the ".atm" and ".trn" files created by MOSART. To run PLTGEN, simply execute the code, which will prompt for the file root name. The same file root that was provided to MOSART should then be provided to PLTGEN. PLTGEN will then prompt the user for information on whether wavelength or wavenumber plots are desired (note: the other value is given on the top axis) and whether linear of logarithmic (or both) are desired. PLTGEN also has the capability to degrade the resolution of the spectral parameters and will request the spectral resolution desired in either cm^{-1} or μm. The spectral parameters will be convolved with a triangular slit function with a full-width at half maximum (FWHM) corresponding to the specified resolution. A square slit function is also available (but commented out) in the routine SLITFN, and a user-defined slit function can easily be added. Finally, PLTGEN will ask whether each type of plot is desired. The NCAR plotting package, as delivered, will then create a "gmeta" file containing the plotter commands. The SUBROUTINE SYSTEM can then submit this file to a plotter or laser printer. As delivered, SYSTEM executes the command file:

```
#
# Command file to translate GMETA files and spool the translator output
#
# set the environment variables
#
set metafile = gmeta
set device = 'ps.mono'
setenv  GRAPHCAP  /usr/local/lib/graphcaps/$device
/usr/local/bin/ctrans -d $device $metafile | lp -dpanasonic
rm gmeta
#
```

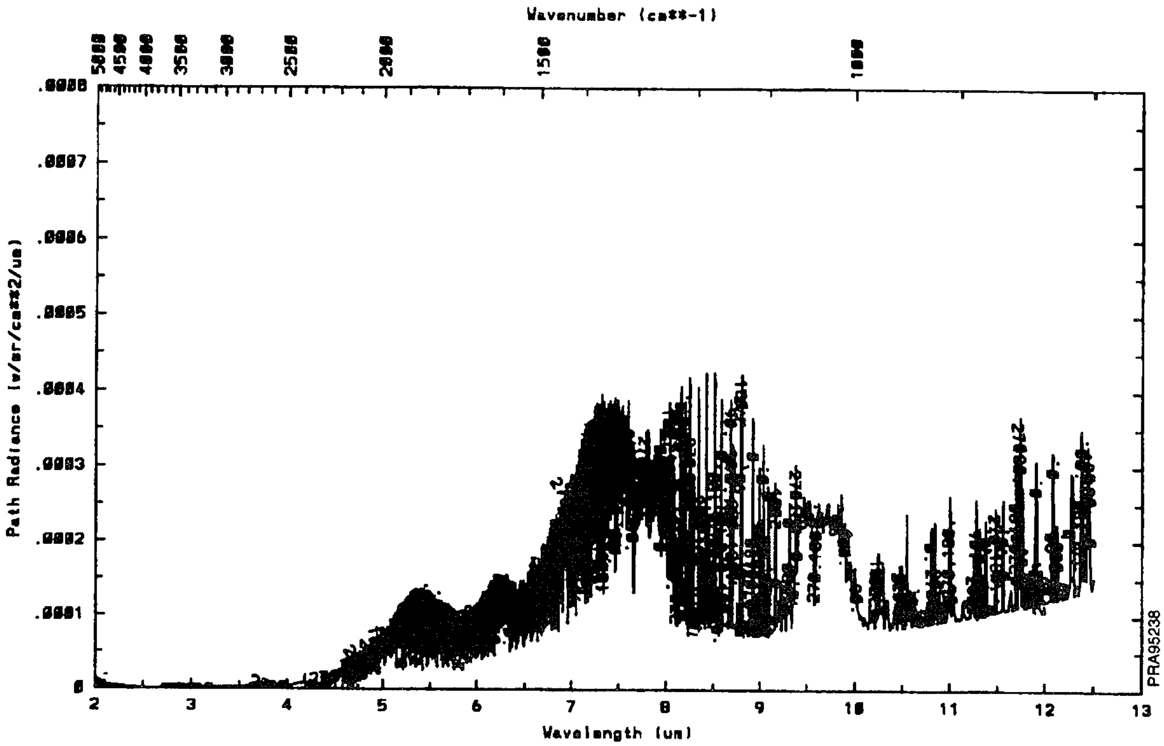


Figure 10. Observer-Source Path Radiance vs. Wavelength/Wavenumber (linear scale).

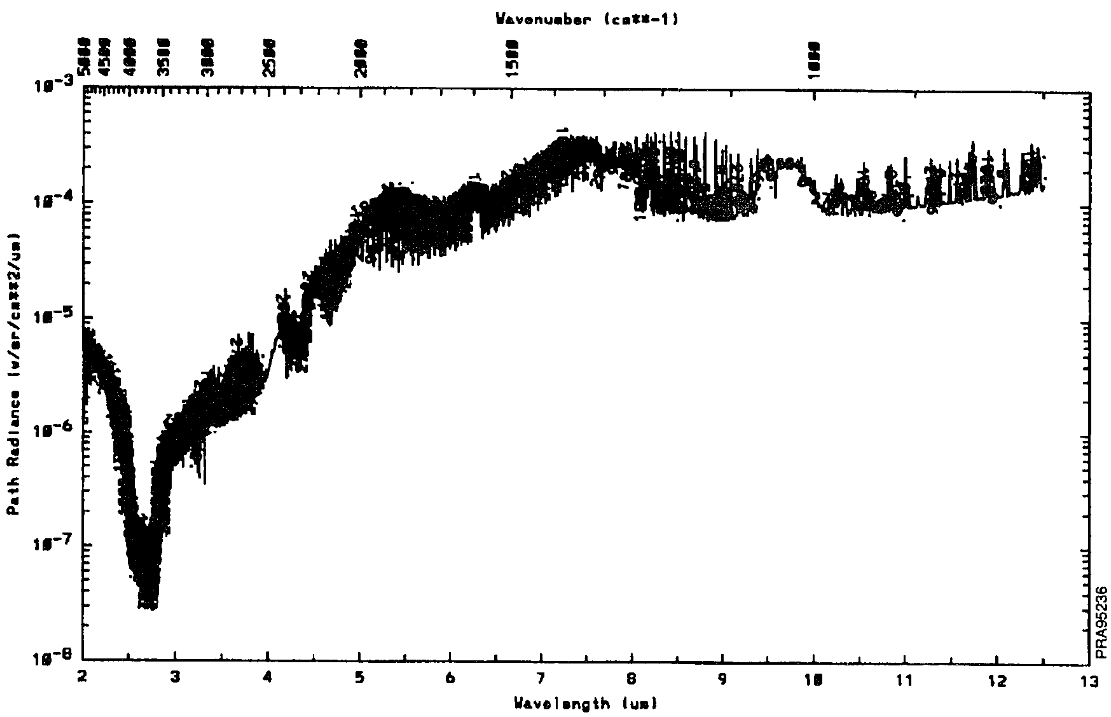


Figure 11. Observer-Source Path Radiance vs. Wavelength/Wavenumber (logarithmic scale).

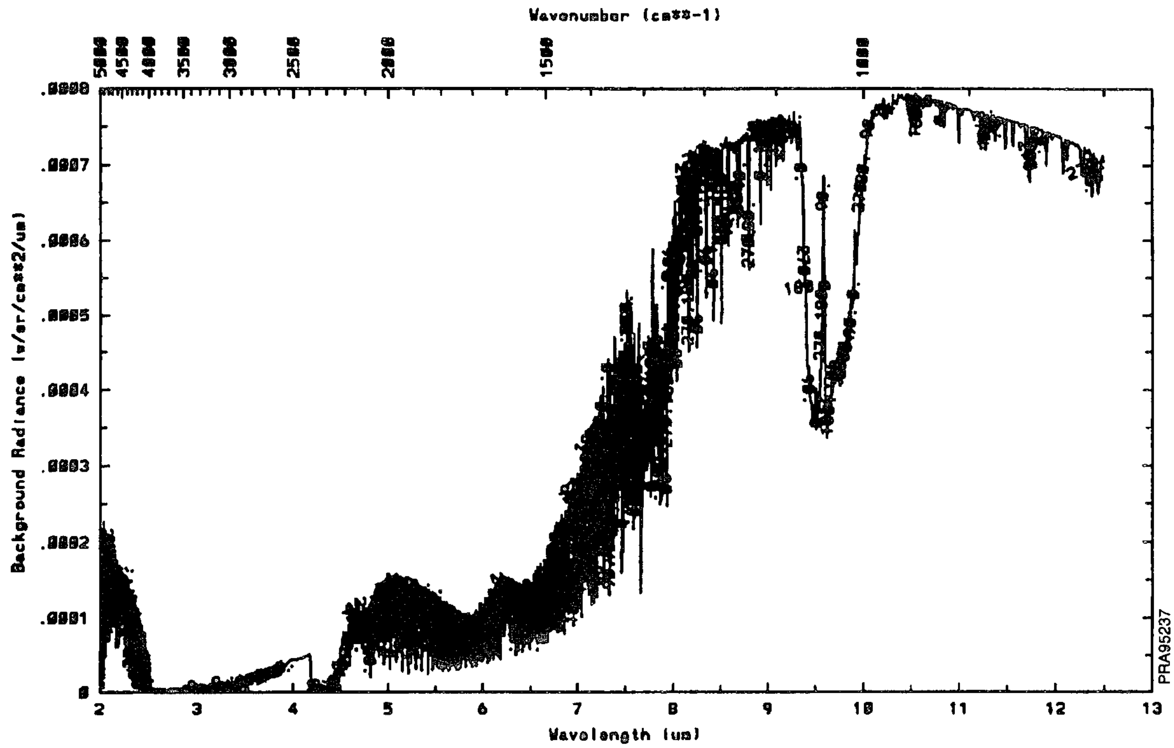


Figure 12. Background Radiance vs. Wavelength/Wavenumber (linear scale).

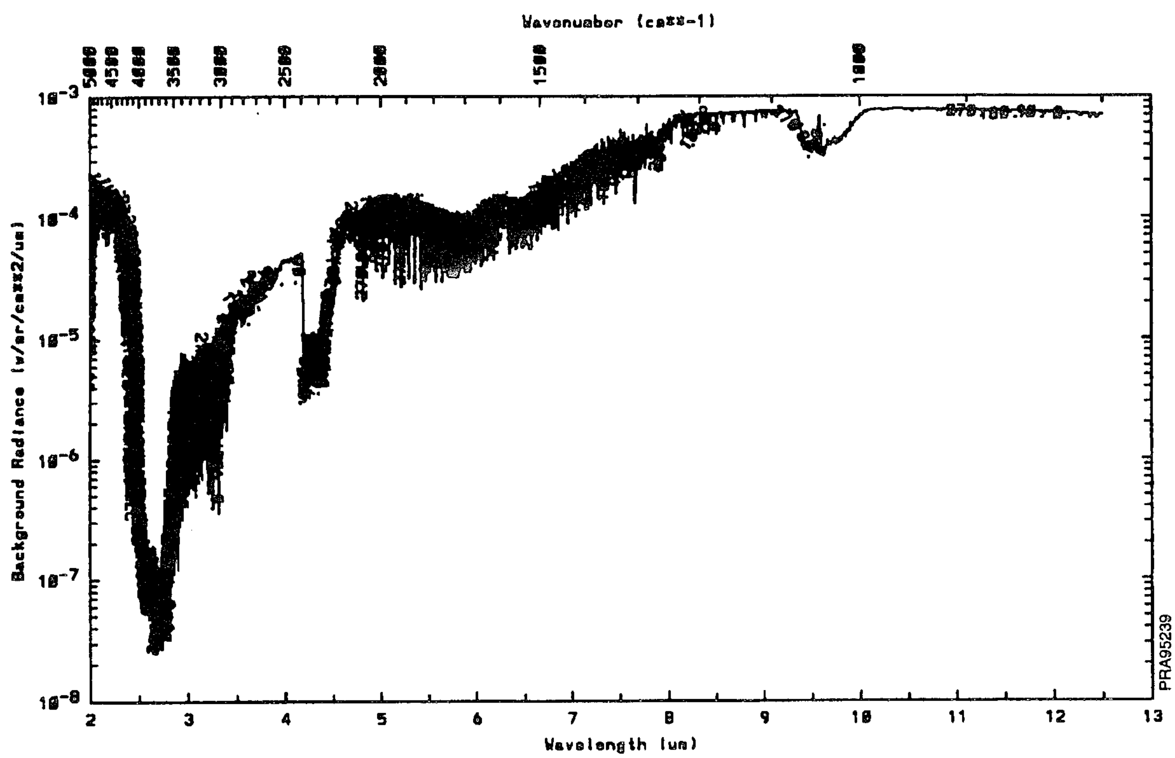


Figure 13. Background Radiance vs. Wavelength/Wavenumber (logarithmic scale).

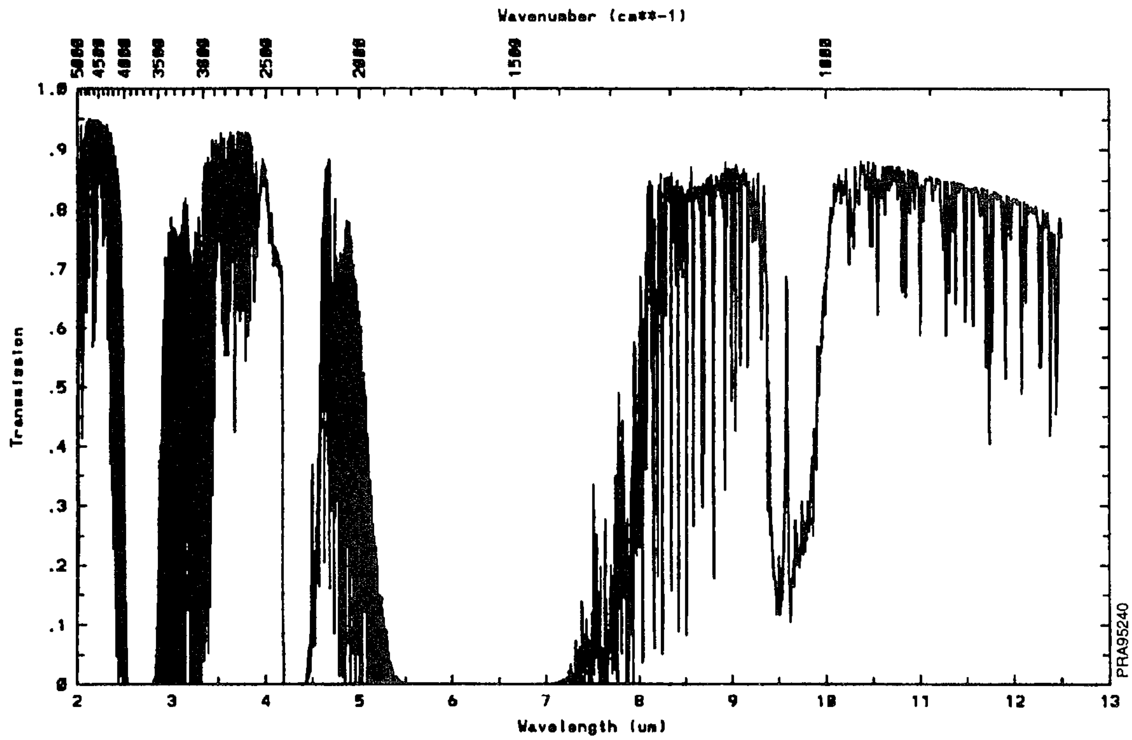


Figure 14. Observer-Source Transmittance vs. Wavelength/Wavenumber (linear scale).

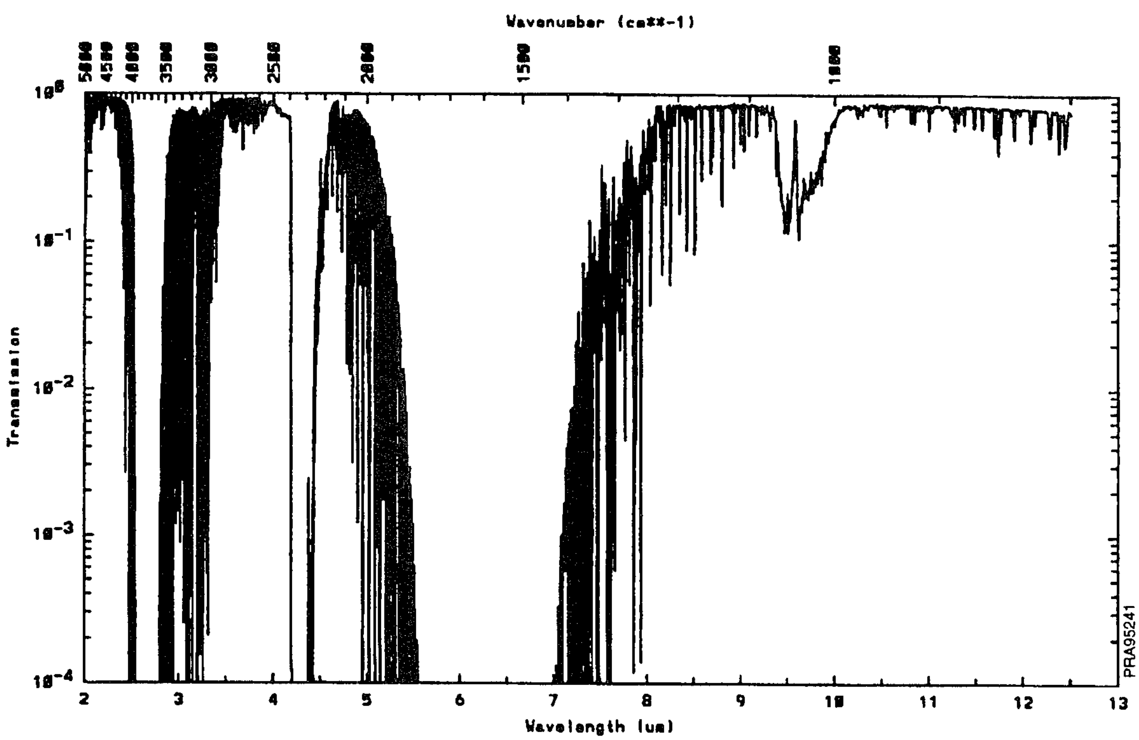


Figure 15. Observer-Source Transmittance vs. Wavelength/Wavenumber (logarithmic scale).

This command file is specific to the computer upon which it was developed. It translates the gmeta file into a format acceptable to a laser printer and submits the results to a printer called "panasonic." It then deletes the gmeta file. During the installation, PLTGEN should have been customized as required for your system.

If you installed PLTGEN with the DISSPLA plotting package or your own plotting package (see Installation Reference Manual), you should submit plot files in accordance with the procedures for your system.

6.3 Blackbody Temperature (BBTEMP) Utility

BBTEMP converts the radiances in either the ".atm" or ".bck" (or both) files into equivalent blackbody temperatures. The conversion is relatively simple and should only be used for relatively narrow spectral bands. The equivalent blackbody temperature, T, is defined so that

$$N = P(T,\nu)\ \Delta\nu$$

where N is the integrated in-band radiance (perhaps weighted by a filter response function;
P is the Planck blackbody function;
ν is the wavenumber in the center of the band; and
$\Delta\nu$ is the bandwidth.

BBTEMP expects to be able to read either the ".atm" or the ".bck" file that was created by MOSART. To run BBTEMP, simply execute the code, which will prompt for the file root name. The same file root that was provided to MOSART should then be provided to BBTEMP. It will then prompt for a filter type. A response of "0" will automatically give you a square filter response for the spectral bands in the ".atm" and ".bck" files. If a non-zero response is given, the code will then prompt for a filter file name, which is expected to have the same format as a filter response file for MOSART or MODTRAN. A sample BBTEMP output is shown in Appendix B.

NOTE: Currently, BBTEMP overwrites the ".out" file. If you don't want to lose this file, change its name.

6.4 Visual (VISUAL) Utility

VISUAL converts the radiances in either the ".atm" or ".bck" (or both) files into luminances. MOSART should have been executed for the full spectral region from 0.340 to 0.780 μm in order to cover the full spectral response of the eye. VISUAL

determines the appropriate spectral eye response curve (see Figure 16) based upon the background illumination level. It converts radiance to luminance and irradiance to illuminance. Furthermore, it uses the CIE Tristimulus Model (see Figure 17) to determine the color content of the luminance values and provides them in the form of X-Y coordinates on the CIE Chromaticity Diagram (see Figures 18 and 19). Other color coordinates are available (e.g., R-G-B, U-V) and can provided if a need exists (e.g., Figures 20 and 21). It should be noted that the X-Y chromaticity coordinates given by VISUAL do not account for the impact of viewed area on color perception (see Figure 22 and Table 23).

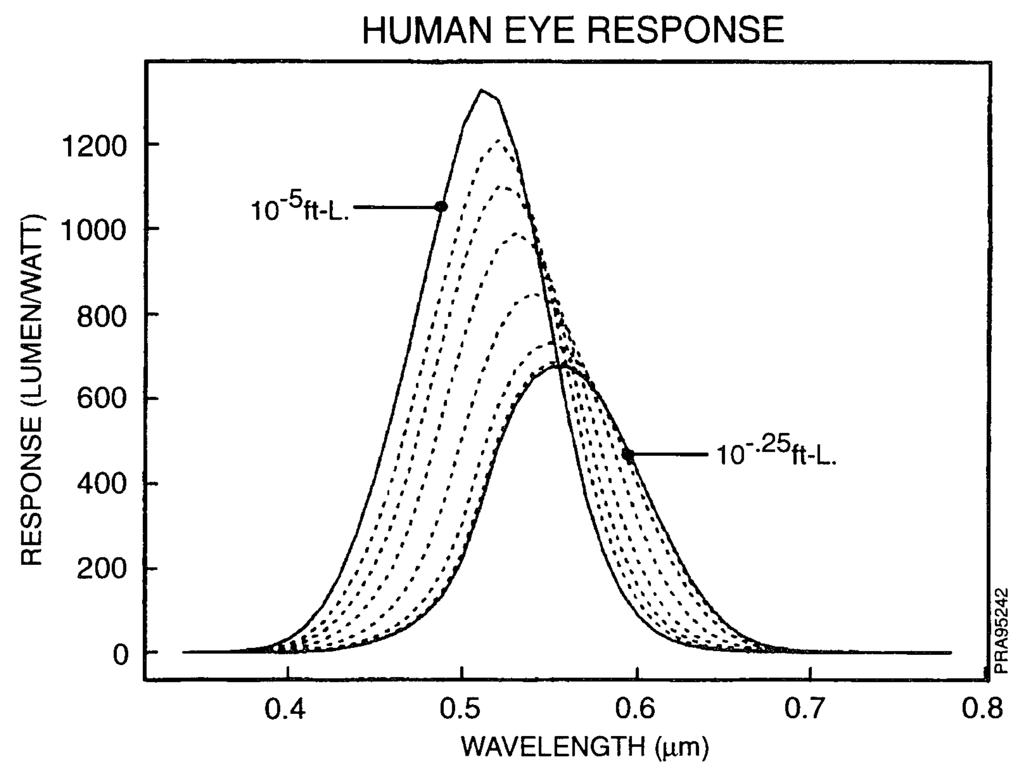


Figure 16. Human Eye Response.

VISUAL expects to be able to read either the ".atm" or the ".bck" file that was created by MOSART. To run VISUAL, simply execute the code, which will prompt for the file root name. The same file root that was provided to MOSART should then be provided to VISUAL. A sample VISUAL output is provided in Appendix C.

NOTE: Currently, VISUAL overwrites the ".out" file. If you don't want to lose this file, change its name.

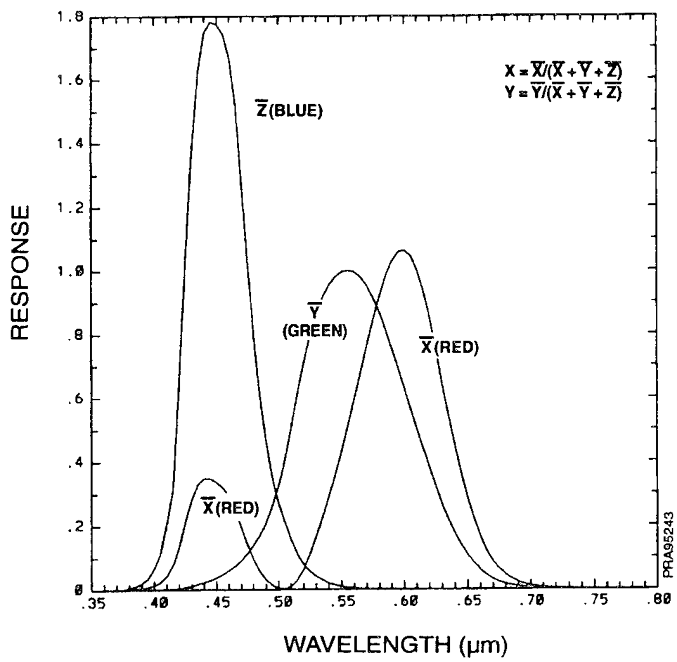


Figure 17. CIE Tristimulus Curves.

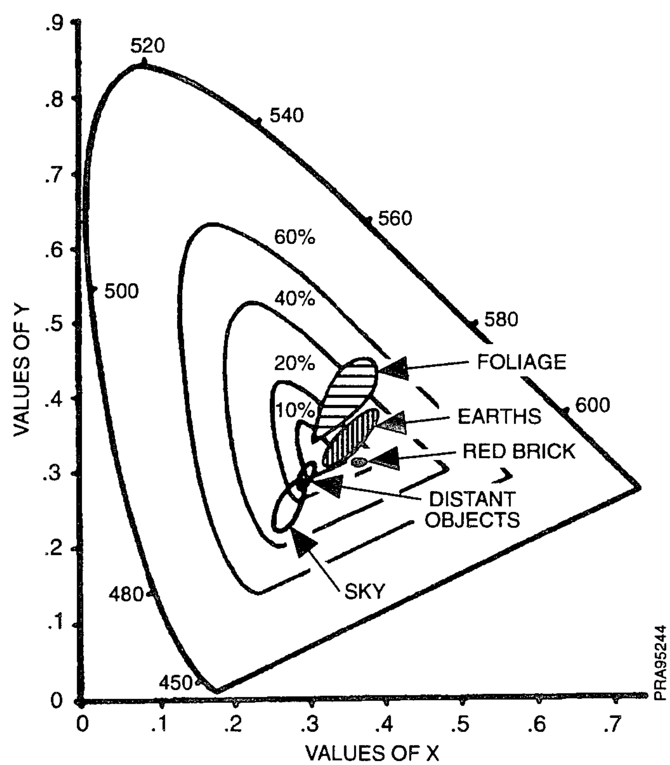


Figure 18. CIE Chromaticity Diagram.

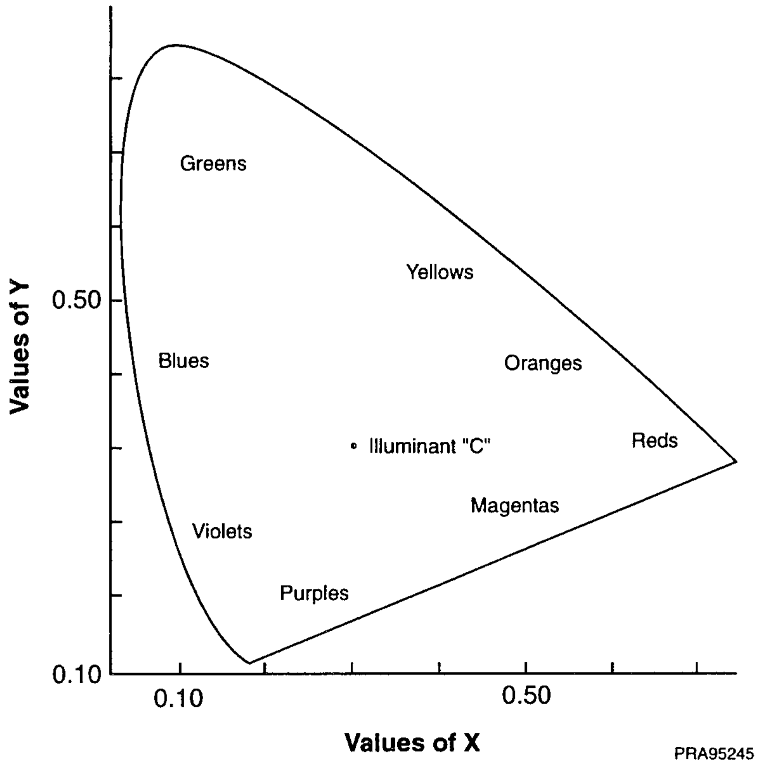


Figure 19. Chromaticity Diagram.

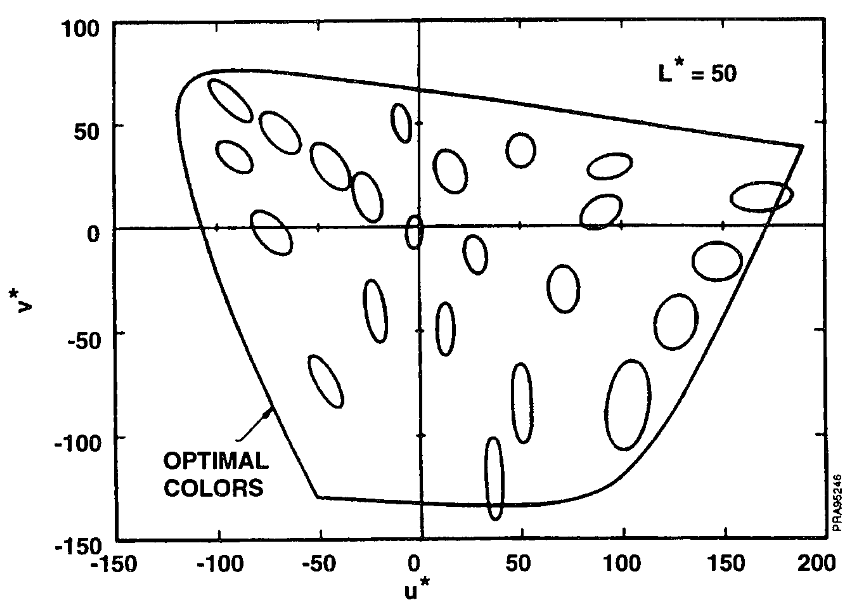


Figure 20. CIE (u*,v*) Diagram.

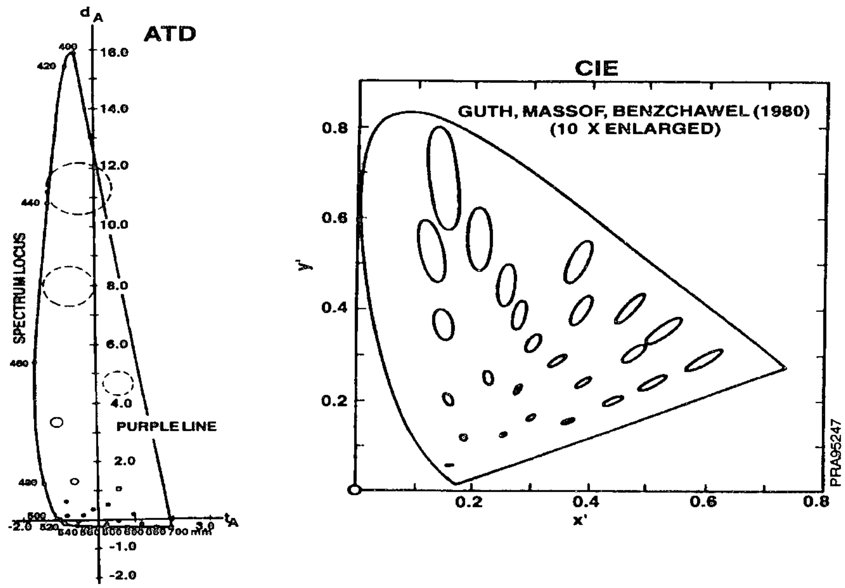


Figure 21. ATD - Color Space.

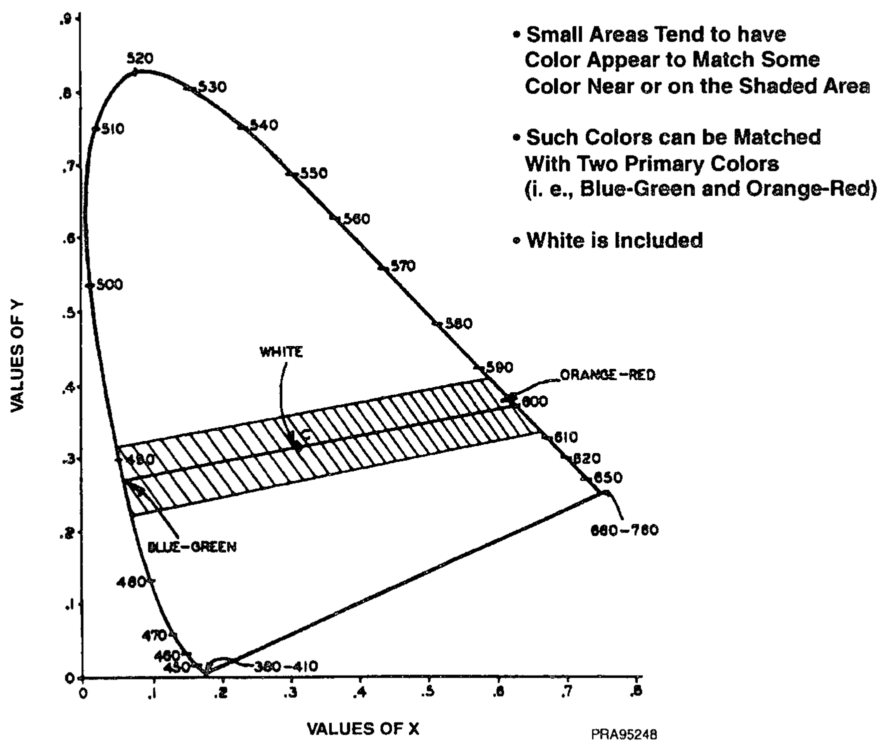


Figure 22. Impact of Viewed Area on Color Perception.

Table 23. Impact of Viewed Area on Color Perception.

As the colored surface area decreases, the following colors (of same brightness) become indistinguishable:

Level I:	Blues ↔ Grays	
Level II:	Yellows ↔ Grays Browns ↔ Crimsons Blues ↔ Greens	 Reds are Distinct from Blue-Green
Level III:	Blue-Greens ↔ Grays	
Level IV:	Reds ↔ Grays	
Level V:	Normal Vision Devoid of All Color Sensation	
Note: Levels are arbitrary and indicate only relative stages in the loss of color discrimination.		

6.5 MOSART Filter Integration (MRFLTR) Utility

MRFLTR is a utility that allows the user to integrate ".atm" or ".bck" (or both) files over different spectral bands and for different filter response functions. The spectral band must be contained within the spectral range of the original MOSART calculation.

MRFLTR expects to be able to read either the ".atm" or the ".bck" file (or both). To run MRFLTR, simply execute the code, which will prompt for the file root name. The same file root that was provided to MOSART should then be provided to MRFLTR. The code will then provide you with the spectral band limits of each of the spectral bands in the ".atm" and/or ".bck" files and prompt for the desired spectral limits of integration. If a filter response function is desired (other than a square response), the name of the filter response file should be placed in the appropriate place in the MOSART input (".in") file. If the original ".in" file did not contain the section for specifying a filter response file name, simply add this section for use by MRFLTR.

As with the use of a filter file during the execution of MOSART, multiple, disjoint filters can be included in the filter file. There should be a correspondence between the spectral ranges in each spectral interval and the spectral coverage of each disjoint filter.

The output from MRFLTR is identical to the OUTPUT from MOSART, except that the following sections are omitted:

- Atmospheric Profiles
- Terrain Material Temperatures
- Terrain Material Radiances and Structure

Also, if only one of the binary data files is retained, MRFLTR will provide just the output available from that file.

Note: Currently MRFLTR overwrites the ".out" file. If you don't want to lose this file, change its name.

6.6 ASCII-to-Binary (ASCBIN) Utility

ASCBIN allows the user to manipulate the binary data files created by MOSART in the following ways:

- Create ASCII versions of the binary data files
- Convert these ASCII files back to binary files
- Create ASCII spectral tables

ASCBIN expects to be able to read any of the binary data files created by MOSART, but currently it can create tables only for the ".atm", ".bck", and ".htr" files. To run ASCBIN, simply execute the code, which will prompt for the file root name. The same file root that was provided to MOSART should then be provided to ASCBIN. A menu is then provided:

```
Select type of work desired -

    0 - Terminate job execution
    1 - Perform a binary to ASCII file conversion
    2 - Perform an ASCII to binary file conversion
    3 - Create a spectral tabular output
```

Based upon the selection, the user is prompted for the binary file with which the user wishes to work; for example:

```
Binary file desired -
  atm (a)
  bck (b)
  htr (h)
```

The user should supply the letter corresponding to the file to be converted.

The ASCII conversion allows the user to examine numbers in the binary files directly. However, the ASCII files are not labeled, and a detailed knowledge of the contents of the binary file is required. This conversion, when coupled with the reverse, allows the binary files to be transferred between machines with incompatible binary file formats. However, it should be noted that some precision (i.e., significant figures) will be lost in the conversion process. All ASCII converted parameters are placed sequentially in the file having the appropriate file root and the suffix ".asc". In order to convert back to binary, the user must remember what files were converted and in what order to avoid mixing the files. One can use the IFILE variable in the header which is output with the request for a file name (see Section 5.2.1) to assist in determining the file type.

The spectral tables contain a variety of spectral information. This includes wavenumber (cm^{-1}) and wavelength (μm) along with requested spectral values. All radiometric values are given per wavenumber ($/cm^{-1}$), per wavelength ($/\mu m$), and as a running integral. The running integral allows the user to easily integrate the values between any desired spectral values by simply subtracting appropriate values of the running integral. Also, as discussed in Section 6.2, ASCBIN can convolve the tabular data with a slit function to obtain the desired resolution. All tabular output is placed sequentially in the file having the appropriate file root and the suffix ".tbl".

A number of table options are available:

For ".atm" files:

0 - Return to main ASCBIN menu
1 - Basic Observer-Source Data
2 - Azimuthal Observer-Source Data (Type I)
3 - Azimuthal Observer/Source Data (Type II)
4 - Basic Observer-Background Data
5 - Azimuthal Background Data (Type I)
6 - Azimuthal Background Data (Type II)
7 - Azimuthal Background Data (Type III)
8 - Basic Earth/Skyshine Data
9 - Azimuthal Earth/Skyshine Data

For ".bck" files:

0 - Return to main ASCBIN menu
10 - Basic Background/Altitude Data (Type I)
11 - Basic Background/Altitude Data (Type II)
12 - Azimuthal Background/Altitude Solar Data

The contents of each of these tables are presented in Appendix D. Depending upon the table requested, the code will prompt for information on observer/source azimuth, earthshine/skyshine aspect and azimuth, or altitude. The user can cycle through the various menus and parameters as desired.

6.7 FACET Utility

The FACET code is a detailed code for determining the emitted and reflected energy from a simple (i.e., flat), or compound (i.e., cylindrical or spherical) surface.

The FACET code, when executed provides the following on-screen message:

```
FFFFFFFFF      A       CCCCCCC   EEEEEEEEE TTTTTTTTT
F             A A     C       C E              T
F            A   A    C       C E              T
FFFFFF      A     A   C         EEEEEEE        T
F          A       A C          E              T
F          AAAAAAAAA C          E              T
F          A       A C        C E              T
F          A       A C        C E              T
F          A       A  CCCCCCC   EEEEEEEEE      T

                        (Version 2.00)
                        (30 June 1994)
```

It then prompts for the input file name:

```
Input file name:
```

and the output file name:

```
Output file name:
```

Please note that full file names (as opposed to file roots) are required for both the input and output files.

The FACET code will then summarize (on the computer terminal) the geometry (or geometries) used for the calculations:

Geometry Conditions (1 positions)

No	Target Altitude (Km)	Receiver Altitude (Km)	Slant Range (Km)	Ground Range (Km)	Trgt.Elev. Angle (deg)	Rcvr.Elev. Angle (deg)
1	10.00	1600.00	1590.01	0.00	90.00	-90.00

and provide the user with the heading, title, and creation date and time of the atmosphere file:

```
Facet Test File
APART Radiative Environment Summary (Ver. 7.61) Fri Oct 21 15:37:58 1994
```

If no problems are encountered, it will terminate with:

```
STOP Normal termination statement executed
```

or some similar message (depending upon the method used to handle messages on FORTRAN STOP statements).

The FACET input file is in PRA-standard format (i.e., 40-character text, followed by up to 40 characters of input, except for tabular input). The first two lines of a FACET input file are a title line and a dot ("."), which is used to separate sections:

```
Facet Reflection/Emission Code (Version 2.00) 30 July 1994
.
MOSART Atmospheric Binary Data File .... facet_src/mosart.atm
Filter Response File Name .............. None
.
```

The next input section specifies the MOSART or APART (depending upon the version of FACET) atmospheric binary data file (i.e., the ".atm" file) name and the filter response file name. If no spectral filter is desired, the character string "None" should be input, and a square filter is used. Except for the actual file name, FACET input is case insensitive (i.e., "none", "None", "nOnE", and "NONE" are eqiuvalent input).

In generating the ".atm" file, care should be used to insure that appropriate solar conditions have been selected, along the correct observer-source geometry. Also, an earth/skyshine grid should be generated.

Again, a dot (".") is used to terminate the section.

```
Shape (SFacet/DFacet/Cylin./Sphere) .... Facet
Facet/Axis Normal Vector (x,y,z) .......  0.0  0.0 -1.0
Facet Temperature (K) ..................
Grid Spacing (Fine/Medium/Coarse) ...... Coarse
.
```

The next section defines the surface. Four (4) different types of surface Shapes are allowed:

Single-sided facet
Double-sided facet
Cylinder
Sphere

The single-sided facet can only emit and reflect from the side defined by the surface normal vector, while the double-sided facet can emit and reflect from both sides. In both cases, the facet has an area of 1 cm^2.

The cylinder is defined so that only the outer surface of the cylinder emits and reflects (i.e., you cannot see the inner surface of the cylinder), and it has no end pieces. The cylinder has radius and length of 1 cm each.

The sphere has a radius of 1 cm.

The Facet/Axis Normal Vector (x,y,z) defines either the surface normal to the facet (it can be either one for the double-sided facet) or the axis of revolution for the cylinder. If the vector is not normalized, the code will normalize it.

The Facet Temperature is the temperature of the surface in Kelvin. If this input is left blank, the surface temperature is set to the ambient temperature at the source (target) altitude.

Finally, the Grid Spacing specifies both the integration step over the surface curvature and over the earth/skyshine angles. The angular increments are:

Coarse:	10 degrees
Medium:	5 degrees
Fine:	1 degree

It should be noted that, while the fine grid spacing will provide more accurate integration, it increases the execution considerably, particularly for the sphere, where integration occurs over both elevation and azimuth; the grid spacing is less of a consequence for cylinders, and has only a minor impact for flat facets, where is modifies the integration for the earth/skyshine.

As an example of the impact of Grid Spacing on the accuracy of the results, the maximum projected area of a cylinder is calculated to 1.995 cm^2 with a Coarse grid (where it should be 2.000 cm^2), and the projected area of a sphere is calculated to be 3.130 cm^2 with a Coarse grid (where it should be 3.1416 cm^1).

Again, a dot (".") is used to terminate the section.

```
Facet Surface (Dif/Dir/Bid) ........... Directional
Roughness Type (Gaussian/Expon.) ....... Gaussian
Roughness Standard Deviation (m) ....... 250.E-06
Correlation Length (m).................. 800.E-06
.
```

The next section defines the surface properties. The surface can be modelled as one of three (3) different surface types:

Diffuse (or Lambertian) Reflections and Emissions
Directional Reflections and Emissions
Bidirectional Reflections and Directional Emissions

The Roughness Type (i.e., either Gaussian or Exponential), refers to whether the surface is smoothly varying (i.e., Gaussian) or very jagged (i.e., Exponential). The Roughness Standard Deviation and Correlation Length are used to specify the roughess of the surface. The Roughness Type and the Correlation Length are only used for the bidirectional surface type, while the Roughness Standard Deviation is also used for the directional surface.

Again, a dot (".") is used to terminate the section.

The last section is a table of spectral values. For the Diffuse and Directional Surfaces, the Normal (or Diffuse) Reflectivity must be specified as a function of wavelength. Values must be included for the Real and Imaginary Index of Refraction since the code uses free-format reads, but they are not used, except for the Bidirectional Surface.

Optical Properties of Surface

Wavelength (um)	Normal Reflectivity	Index of Refraction Real	Imaginary
0.20	0.18	1.33	0.01
0.80	0.16	1.33	0.02
0.90	0.13	1.33	0.01
1.00	0.10	1.33	0.03
2.00	0.08	1.33	0.05
3.00	0.06	1.33	0.07
4.00	0.04	1.34	0.09
5.00	0.02	1.34	0.10
6.00	0.01	1.34	0.12
7.00	0.008	1.34	0.14
8.00	0.006	1.34	0.16
9.00	0.006	1.34	0.18
10.00	0.008	1.34	0.20
11.00	0.01	1.35	0.22
12.00	0.01	1.36	0.22
13.00	0.02	1.38	0.22
14.00	0.03	1.40	0.22
15.00	0.06	1.42	0.22
16.00	0.05	1.48	0.22
17.00	0.04	1.52	0.22
18.00	0.03	1.52	0.22

```
   20.00          0.00          1.52          0.22
End of spectral data/
```

A sample output is shown in Table 24. The first section is a summary of the atmospheric conditions and the geometry. The second section defines the surface, and the third section provides the total emitted and reflected radiance from the surface. The elements are:

Azimuth:	Observer azimuth as defined in the ".atm" file
Apparent Signature:	Total emitted and refected radiance as seen at the observer
Contrast Signature:	Apparent signature minus the part of the background obscured by the surface
Relative Contrast:	Contrast Signature divided by the total background
Path Radiance:	Radiance between the observer and the surface
Background Radiance:	Radiance obscured by the surface
Projected Area:	Area of the surface seen by the observer

6.8 Scene Generator Utility

The Scene Generator (SCNGEN) is a software tool for generating statistical background scenes. Each scene can consist of a number of "materials", each of which has a mean radiance, standard deviation, and power spectral density (PSD). The "materials" are combined in a fractal algorithm, using a user-defined mask.

SCNGEN is a separate utility that does not directly use any of the files created by MOSART. However, some of the terrain material parameters provided in the ".out" file can be used in the input file to SCNGEN.

To run SCNGEN, simply execute the code, which will prompt for the file name. SCNGEN differs from the other utility codes in that it expects to be given the complete input file name, not just the root. A sample SCNGEN input file is shown in Figure 23.

The scene output file name provides SCNGEN with an output file name in which the calculated scene will be written as a direct access, binary file with a record length of 1024 REAL variables (4096 bytes) and 1024 records. SCNGEN allows the user to provide a material mask and a cloud radiance scene for SCNGEN. If not provided (by specifying "none"), a fractally generated material mask is used. The format of the mask file is:

Table 24. Sample FACET Output File.

```
Latitude  =      0.000 deg North
Longitude =     43.211 deg West
Date      = 20 Mar 1988
Time      =  0:00:00.0 (GMT)

Midlatitude (45 N. Lat.) Summer Atmosphere (Exospheric temperature = 1000.0 K)
Rural Boundary Layer Aerosol Model (Visibility = 23.0 Km)
Background Stratospheric Aerosol Model (Temp.Dep.)
Shettle/Fenn Background Summer Aerosol Profile
Normal Upper Atmosphere Aerosol Profile
Standard boundary layer vertical structure

Terrain type - Desert Land/Sea Interface (Salton Sea, CA)
  Terrain altitude          =    0.000 Km
  Air temperature           =    294.2 K
  Water temperature         =    294.2 K
  Sub-surface temperature =    294.2 K
  Wind speed                =     4.10 m/sec
  Surface turbulence, Cn2 =  1.400E-14 m**-2/3
  Av. hi alt. wind speed  =     0.00m/sec
```

Table 24. Sample FACET Output File (continued).

```
Receiver azimuth angles (deg) ( 1 positions) relative to sun

        180.00


Geometry conditions (     1 positions)

        Target    Receiver        Slant      Ground   Trgt.Elev.  Rcvr.Elev.
No     Altitude   Altitude        Range      Range       Angle       Angle
         (Km)       (Km)          (Km)       (Km)        (deg)       (deg)

 1       10.00    1600.00       1590.01      0.00        90.00      -90.00

Receiver aperture       -      1.000 meters
Receiver field of view -       1.000 mrad

File root name - facet.out
     Input file             - .in
     ASCII output file      - .out
     Target data file       - .atm
```

Table 24. Sample FACET Output File (continued).

```
Facet Test File
APART Radiative Environment Summary (Ver. 7.61) Fri Oct 21 15:37:58 1994


Double-sided Flat facet
   Coarse (10 deg) grid
   Emission/Reflection Model:  Directional
   Temperature                =    -9999.00 K
   Gaussian Roughness
     Standard Deviation =   2.5000E-04 m
     Correlation Length =   8.0000E-04 m
   Unit Normal Vector:        0.0000       0.0000      -1.0000
```

Table 24. Sample FACET Output File (continued).

```
Facet Test File
APART Radiative Environment Summary (Ver. 7.61) Fri Oct 21 15:37:58 1994

Geometry No.      1
Target Signature

Freq.range  2260.0 to  2260.0 cm-1 or    4.425 to    4.425 um
Wavenumber increment =     5.0 cm-1
Equiv.Bandwidth =     5.0 cm-1 ( 0.0098 um)  Square response


Azimuth ---- Signature ----  Relative ----- Radiance ----  Projected
 (deg)  ------ (w/sr) -----  Contrast ------ (w/sr) -----     Area
         Apparent  Contrast               Path   Background  (cm**2)

 180.0  1.078E-08 1.607E-07     1.788 2.398E-07 8.987E-08     1.000
```

```
Statistical Scene Generator Input File (Ver. 1.00) 23 January 1992
.
Scene Output File Name ................. scngen.dat
Material Mask File Name ................ /proj/mosart/scngen_src/europe.mat
Cloud Mask File Name ................... None
.
Pixel size (m) ......................... 2600.
Scene output size (N x M) .............. 325  1024
Random number seed ..................... .1
Fractal mask dimension ................. 2.99
Use random additions in mask (Y/N) ..... N
Cloud cover fraction ................... 0.50
Observer elevation angle (deg) ......... -45.
.
Material Parameters
Name       No. Fraction  --- Mean Radiance --- Standard   Correl.   PSD     Mask
---------                    (w/cm**2/sr)      Deviation  Length    Slope    Wt.
                          Sun          Shade               (m)
Path        0  0.0000   3.4690E-05   3.4690E-05   -3.167    10.000  1.666    0.0
Frst/Agr    5  0.0056  13.6629E-05  13.6629E-05   -0.319    80.000  1.200    0.0
Dsrt Dune   7  0.0056   9.6216E-05   9.6216E-05   -0.317    80.000  1.200    0.0
Dsrt Wtr    8  0.0056  11.7546E-05  11.7546E-05   -0.279    80.000  1.200    0.0
Frst Mtns   9  0.4098   9.0810E-05   9.0810E-05   -0.148   470.000  1.200    0.0
Ocean/Lk   13  0.2666   7.2747E-05   7.2747E-05   -2.345  4000.000  1.650  -50.0
MxdFrmlnd  14  0.0558   6.2701E-05   6.2701E-05   -0.002   110.000  1.200    0.0
Tundra 1   16  0.0599   8.2740E-05   8.2740E-05   -0.137   110.000  1.200    0.0
Pine Frst  17  0.0599   6.4698E-05   6.4698E-05   -0.001   110.000  1.200    0.0
Frst/Frm   18  0.0599   6.1352E-05   6.1352E-05   -0.001   110.000  1.200    0.0
Savannah   19  0.1452   5.3189E-05   5.3189E-05   -0.098    90.000  1.200    0.0
Chaparral  20  0.0004   6.5233E-05   6.5233E-05   -0.001   100.000  1.200    0.0
Scrub Des  21  0.0539   6.3976E-05   6.3976E-05   -0.145   120.000  1.200    0.0
Tr Forest  24  0.0016   6.3910E-05   6.3910E-05   -0.001    80.000  1.200    0.0
Tr Savnh   25  0.0016   5.3948E-05   5.3948E-05   -0.100    80.000  1.200    0.0
End of Material Parameters/
.
Gradient across scene (Y/N) ............ Yes
  Reference transmission ............... 0.6157
.
    Row No.        Transmission      Path Radiance    Path St. Dev.
       1              0.441            4.938E-05   5.E-08
      85              0.389            5.360E-05   5.E-08
     171              0.316            5.929E-05   6.E-08
     256              0.205            6.707E-05   7.E-08
     339              0.001            7.611E-05   8.E-08
     341              0.000            7.369E-05   7.E-08
     512              0.000            0.000E+00   0.0
    1024              0.000            0.000E+00   0.0
End of Gradient Parameters/
.
```

Figure 23. Sample SCNGEN Input File.

- First record contains the number of columns in the mask, the number of rows in the mask, and the spatial resolutions of the mask with respect to the columns and row, respectively, in meters. If either the number of columns or number of rows exceeds 1024, only the first 1024 values will be used for the mask.
- All subsequent records contain the material number.

Free format ASCII records are used in the mask file. A sample code to read a mask file is:

```
      OPEN(UNIT=IFMSK,FILE=NFMSK,STATUS='OLD',ERR=xxx,
     +     FORM='FORMATTED',IOSTAT=IOS)
      REWIND(UNIT=IFMSK,ERR=xxx,IOSTAT=IOS)
      READ(UNIT=IFMSK,FMT=*,ERR=xxx,END=xxx,IOSTAT=IOS) NCOL,NROW,
     +     RESMSX,RESMSY
      NCP=MAX(NCOL-1024,0)
      NCOL=MIN(NCOL,1024)
      NROW=MIN(NROW,1024)
      DO 101 IY = 1,NROW
         READ(UNIT=IFMSK,FMT=*,ERR=xxx,IOSTAT=IOS) (MASK0(IX,IY),
     +        IX=1,NCOL),(DUM,IX=NCOL+1,NCP)
  101 CONTINUE
      CLOSE(UNIT=IFMSK,STATUS='KEEP',ERR=128,IOSTAT=IOS)
```

The cloud radiance scene file is generated by the CLDSIM code.

The pixel size is the desired size of the output pixels (not necessarily the resolution of the masks, which themselves may be different from one another). In general, the pixel size should be smaller than the mask resolution. Fractals are used to increase the resolution of the mask by mixing materials at boundaries (see comments on mixing below).

The random number seed is used for initiating the random number generator at the start of the run. A random number generator is used to create all fractal masks, as well as to add correlated structure for each material. For the same seed, the same scene will be produced.

The fractal (or similarity) mask dimension, which is not necessarily an integer, is the measure of the random fractal nature of the scene. A D-dimensional self-similar object can be divided in N smaller copies of itself, each of which is scaled down by a factor r, where

$$r = 1/\sqrt[D]{N}$$

or

$$D = \ln(N)/\ln(1/r)$$

The concept of fractal dimension is a basic one in fractal theory. For further information, the reader should refer to any book on fractals, such as The Science of Fractal Images by H-O Peitgen and D. Saupe (Eds.), Springer-Verlag, 1988.

For some applications, it may be desirable to provide random (i.e., white noise) values to the mask, in addition to the fractal structure already used. A switch is provided to include such random additions or not.

The cloud cover fraction is used in lieu of the cloud radiance scene to generate a fractal cloud cover mask will the proper cloud cover fraction.

The observer elevation angle is used to modify the PSD of each material.

The Material Parameters can be obtained from the SCNGEN Terrain Material Summary (i.e., fraction of material, mean radiances in sun and shade, standard deviation, correlation length, and PSD slope). The material number is provided for correlation with the mask, if provided. A nine-character material name is used to assist the user in realting the material number to a material.

The path radiance is a unique "material" in that it is applied over the whole scene on top of the other materials. The path radiance is designated by material number 0.

The mask weight is used in conjunction with the input mask to determine the degree to which the fractal structure will allow one material defined in the mask to become mixed with another material in the mask. If a mask is not used, the mask weights are not used. In the sample input file, Material No. 1 is weighted significantly different from the other materials to avoid any mixing. Materials 2, 3, 4, 6, and 9 are given the same weight so that the fractal structure imposed upon the mask will mix these materials. Materials 5, 15, and 18 are similarly given the same weight so that they will be mixed, but the weights are somewhat different than Materials 2, 3, 4, 6, and 9, so that only a limited degree of mixing will occur.

It is possible to define a gradient across the scene, from top to bottom. If the user requests a gradient, the transmission, path radiance, and path radiance standard deviation are given as a function of the row number. If the material radiance values already include a transmission (e.g., from APART or MOSART), then this transmission should be provided as the Reference transmission.

Figure 24 shows a scene consisting of a single material. The scene consists of 1024 x 1024 pixels. If the total scene was processed the code would take several CPU hours to complete. Instead, a 128 x 128 subscene is processed to provide the

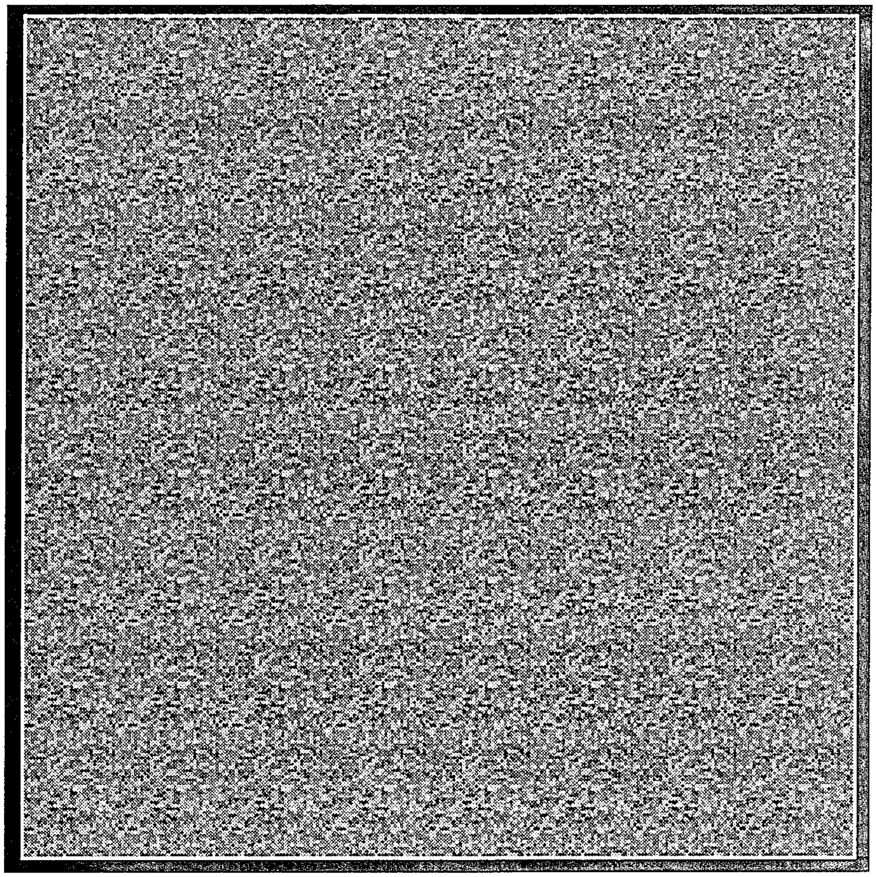


Figure 24. One Material Scene.

proper mean, standard deviation, and power spectral density. The total scene is then "tiled" with this subscene, using a 20-pixel overlap to avoid edge effects. Unfortunately this "tiling", while reducing run time to a few minutes, produces a repetitive structure throughout the scene. To minimize this structure, the scene should be constructed of several identical materials. A two-element scene is shown in Figure 25, where most of the repetitive structure has been eliminated by fractally combining the two materials.

Figure 26 shows a SCNGEN-created radiance map for San Diego, California. The scene mask consisted of a 100-meter resolution map indicating water versus land. SCNGEN fractally resampled the mask at 30-meter resolution, using seven (7) materials. In addition to the fractal and statistical variations of the terrain radiance, the statistical variability of the water is apparent.

It is possible to create a large scene, where each "material" is a smaller scene (obtained from APART or MOSART). Figure 27 shows a portion of Central Europe and North Africa. The boot of Italy, together with Corsica and Sardinia are easily identified, with a little of the Danish peninsula visible at the top. The sample input

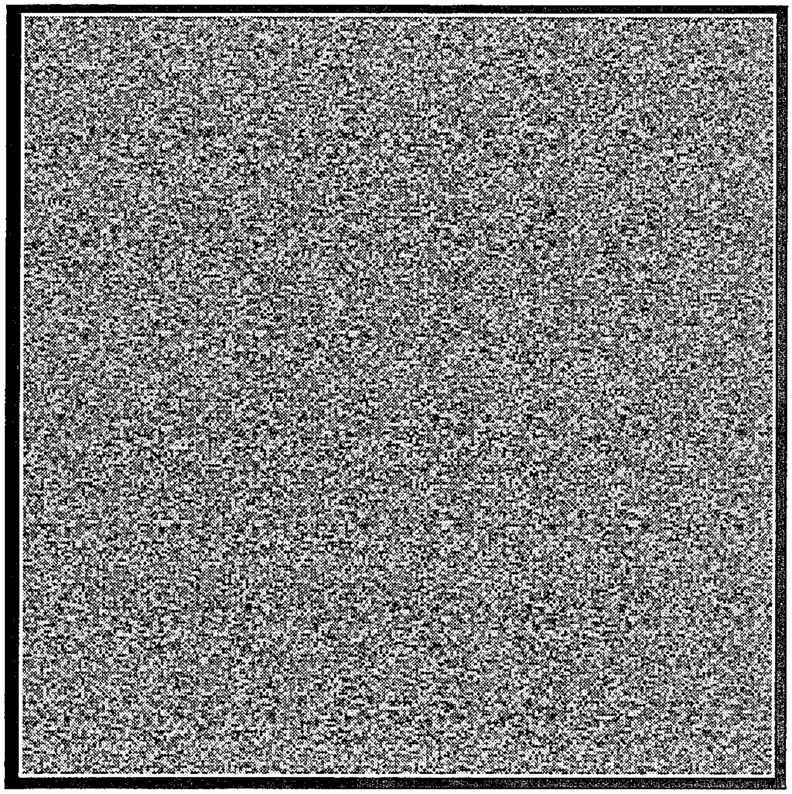


Figure 25. Two Material Scene.

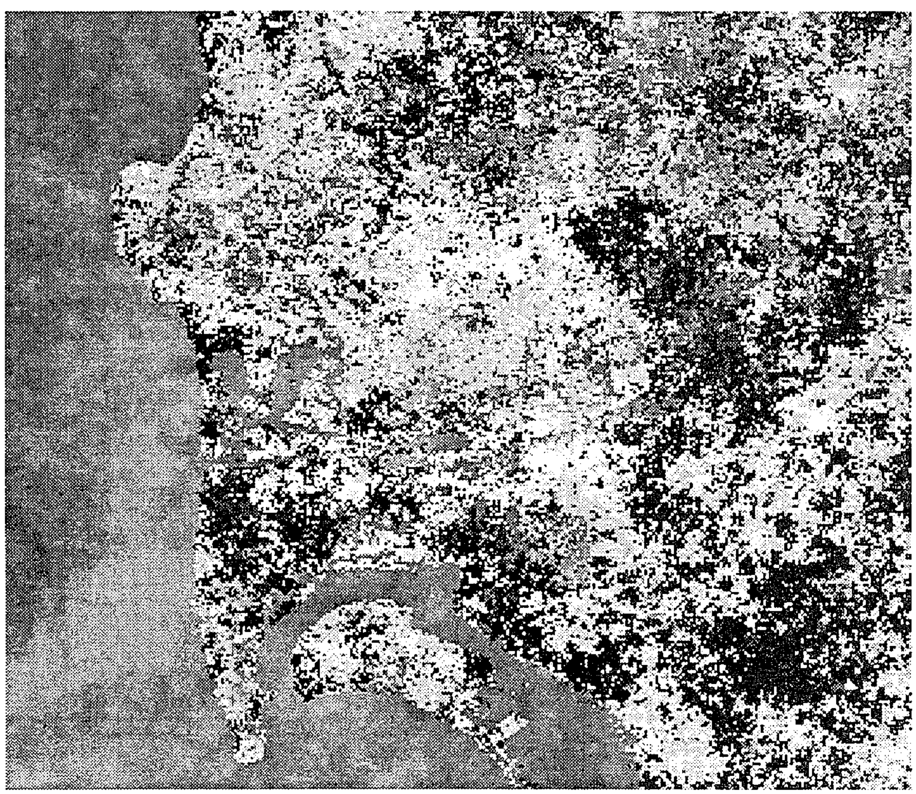


Figure 26. Statistical San Diego, California, Scene.

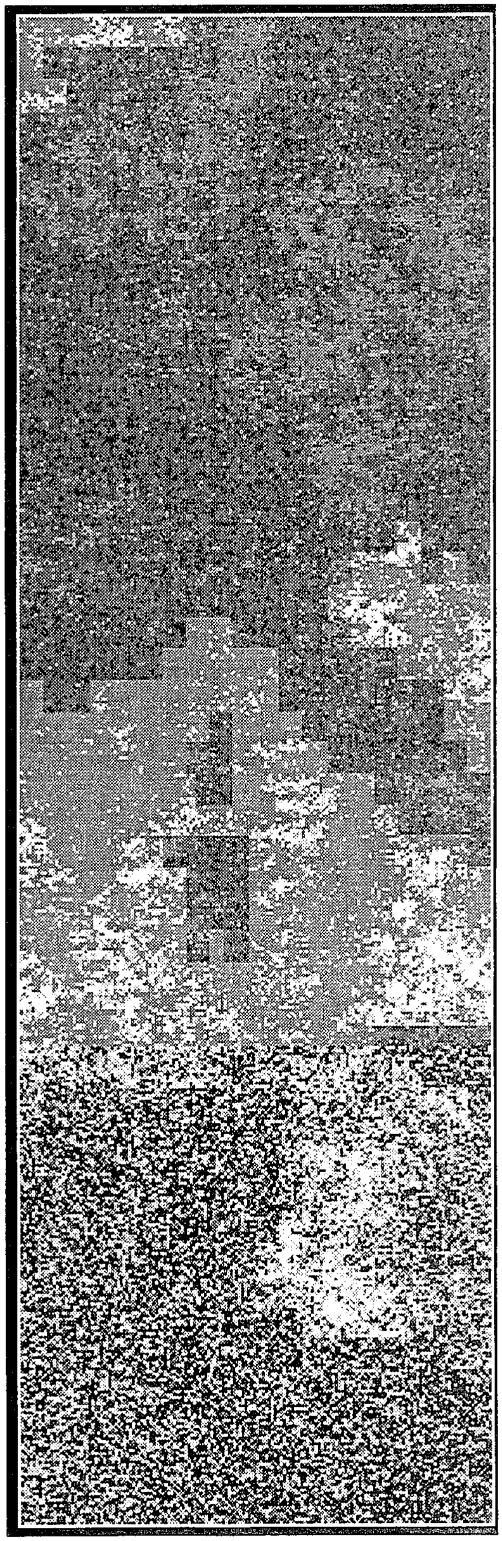


Figure 27. Statistical Scene of Central Europe.

in Figure 23 was used to construct this scene, together with a European mask at approximately 18 km resolution.

Figure 28 shows the same terrain scene as Figure 27; however, a gradient (see Figure 23) has been applied showing the earthlimb and space (the top half of the scene).

6.9 Terrain Temperature (TERTEM) Model

This section describes the MOSART utility for calculating the terrain temperature of a prescribed set of terrain materials for a given set of environmental conditions. The temperatures are provided as a function of time, day, altitude (user-defined grid), and slope (user-defined values). Also, TERTEM permits the user to provide updates to temperatures during the diurnal cycle, perhaps as illumination conditions change.

TERTEM requests the name of the input file, which may include a user-defined material file. Each of these files is presented below.

This input file to the Terrain Temperature (TERTEM) code is in the PRA-standard, self-documenting format, as shown below:

```
Terrain Material Temperature Model (Version 1.00) 11 August 1994
MOSART File Root ...................... /proj/mosart/temp
Output File Name ...................... sample.xxx
User-defined Material File Name ........ /proj/mosart/surmat.dat
Altitudes (km) <<=11) .................. 1.  2.
Fresh Water Temperatures (K) (<=11) .... 280.  265.
Slopes (deg) (<=3) ..................... 10. 45.  80.
Update String:
 Matrl    Initial   Initial Time  Altitude  Sun/Shade    Surface Orientation
 Index Temperature  Time    Step            Condition   Slope        Azimuth
          (K)       (hr)   (min)   (km)                 (deg)          (deg)
  10      288.15    13.25   15.    1.23        Sun      0.00           0.00
End of update data/
```

After the title line (and dot that divides sections of the input file), one specifies the MOSART file root that applies to the calculations (and for which a ".htr" file will exist) and a file name for the output; a dot then terminates this section.

The user then specifies the altitudes (in km) for which the temperature calculations are to be performed, up to a maximum of 11 altitudes. For each altitude, the fresh water temperature (in K) should be specified; however, if fewer temperatures are provided than altitudes, then all temperatures above the last specified altitude are assumed to be equal to the last value given.

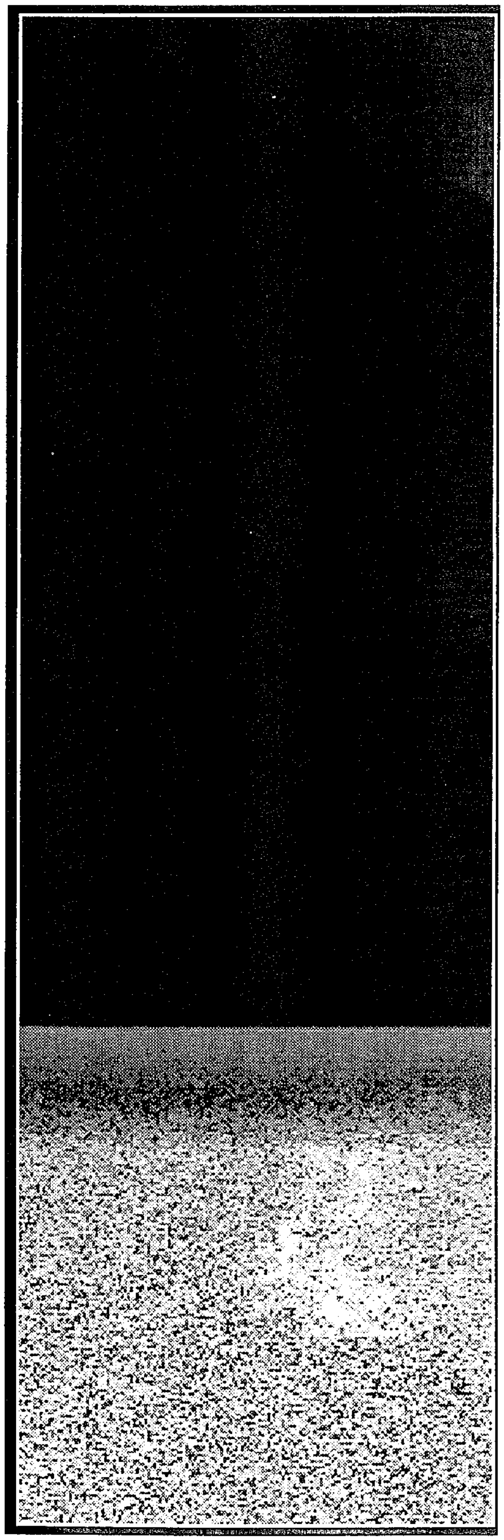


Figure 28. Statistical Scene of Central Europe with Earthlimb and Space.

The user also specifies the slopes desired. The horizontal, or zero, slope is always assumed. Up to three (3) additional slopes can be input.

The dot terminates this section, which is all that is required to calculate the diurnal cycle of temperatures.

For surfaces which require individual attention (e.g., they may have transitioned from sunlit to shade due to a cloud shadow), individual calculations are permitted through the Update String section. After the four (4) text lines, for each material updates, the user inputs the following information:

- Material index (see Table 25)
- Initial temperature (in K): initial condition for the calculation
- Initial time (in hr): starting time for the calculation
- Time step (in min): time increment when next temperature is desired
- Altitude (in km): altitude of surface
- Sunlit/Shade Condition: text input indicating state of illumination
- Surface Slope (in degrees): slope of surface
- Surface Azimuth (in degrees): azimuth of surface normal vector (0 is North, 90 is East, 180 is South, 270 is West)

As with any tabular input, this section is terminated by an "End" and a dot record.

Although not required, it is possible for the user to define up to 100 additional materials thorugh the User-defined Maaterial File Name provided in the input file. This User-Defined Material File consists of a title line (with the following dot), followed by a series of sections, one for each user-defined material. In the example below, two user-defined materials are defined:

```
User-defined Terrain Material Definition File (Version 1.00)  3 April 1995
Label ................................. Painted Asphalt #2
Default Material ...................... Asphalt
Solar Absorptivity .................... 0.500
Thermal Emissivity .................... 0.600
Characteristic Length (m) .............
Evaporation Index (Y/N) ...............
Specific Heat (w-sec/gm/K) ............
Conductivity (w/m/K) ..................
Density (gm/m**3) .....................
Surface Layer Thickness (m) ...........
Sub-Layer 1 Thickness (m) .............
Sub-Layer 1 Material ..................
Sub-Layer 2 Material ..................
Label ................................. Painted Asphalt #2
Default Material ...................... Asphalt
Solar Absorptivity .................... 0.400
Thermal Emissivity .................... 0.600
```

Table 25. TERTEM Terrain Material Indices.

0	None	39	Undefined
1	Fresh Water	40	Undefined
2	Sea Water	41	Undefined
3	MOD. Ocean	42	Undefined
4	GEN. Ocean	43	Undefined
5	First Year Ice	44	Undefined
6	Multi-Year Ice	45	Packd Soil
7	Dry Snow	46	Sand
8	Wet Snow	47	Lm-Slt-Snd
9	MOD. Snow	48	Lmstn-Silt
10	GEN.FrSnow	49	Salt-Silt
11	GEN.OldSnw	50	Silt-Sand
12	Undefined	51	Limestone
13	Undefined	52	Sandstone
14	Undefined	53	Varn. Sand
15	Undefined	54	Vrn.Sndstn
16	MOD. Cloud	55	Dryslt Ply
17	Blackbody	56	Wetslt Ply
18	Whitebody	57	Dryslt Flt
19	Still Air	58	Wetslt Flt
20	Undefined	59	MOD.Desert
21	Undefined	60	Undefined
22	Undefined	61	Undefined
23	Undefined	62	Undefined
24	Undefined	63	Undefined
25	Undefined	64	Asphalt
26	Grass	65	Concrete
27	MOD. Grass	66	Bldg Roof
28	MOD.Dd Grs	67	Undefined
29	MOD.Br Grs	68	Undefined
30	Lawn Grass	69	Undefined
31	Scrub	70	Undefined
32	Pine Trees	71	Undefined
33	BL Tree(S)	72	Undefined
34	BL Tree(W)	73	Undefined
35	MOD.Forest	74	User-defined
36	MOD. Farm	75	User-defined
37	MOD.Mpl.Lf	76	User-defined
38	Undefined		

```
Characteristic Length (m) .............
Evaporation Index (Y/N) ...............
Specific Heat (w-sec/gm/K) ............
Conductivity (w/m/K) ..................
Density (gm/m**3) .....................
Surface Layer Thickness (m) ...........
Sub-Layer 1 Thickness (m) .............
Sub-Layer 1 Material ..................
Sub-Layer 2 Material ..................
```

The label is simply a user-defined text to identify the material. The default material (taken from Table 25) is the material used to fill in all blank fields. In the example, the asphalt is painted with two paints, so the solar absorptivity and thermal emissivity are defined, but all other fields are left blank; therefore, the parameters in TERTEM for Asphalt are used, representing asphalt with a painted surface. The remaining records are used to define the termal properties of the material. The user is referred to the MOSART Technical Reference Manual for definitions.

The file is terminated by two consecutive records consisting of dots (as shown above), or by the end of file.

The output from TERTEM, currently sent to the file specified by the user in the input file, should be considered as very preliminary, since the interface design with the GENESSIS code has not been defined at this time.

The file is presently an ASCII file containing the following information:

For each of the terrain materials (see Table 25):
- The name of the material, then
- For each altitude in the user-defined grid:
  - The altitude in kilometers, then
  - For each time increment:
    - The local solar time (hr),
    - The surface temperature for a horizontal, shaded surface (K),
    - The surface temperature for a horizontal, unshaded surface (K), then
    - For each user-defined slope:
      - The slope (deg),
      - The surface temperature for a North, East, South, and West facing surface (K).

Currently, the update portion of the input file, while implemented, does not produce any output.

7.0 WARNING AND ERROR MESSAGES

MOSART is fairly forgiving to input errors. However, some checks are made within the program and error and/or warning messages are printed at the terminal (i.e., UNIT=*). The following sections provide information on normal termination, fatal errors, and warning messages. For each warning message (given in numerical order), the message, the routine in which the message exists, and a brief explanation of the cause and suggested action are provided.

7.1 Normal Termination

Each of the programs uses the STOP statement with the CHARACTER constant "Normal Termination" at the completion of the job. According to the ANSI X3.9-1978, "at the time of termination, the . . . character constant is accessible." For most computers this means that the character constant is printed at the terminal.

7.2 Fatal Error Messages

For various reasons, the program may not terminate normally. In each case, the STOP statement uses a CHARACTER constant "Error No. nnn," where "nnn" is some integer number. In addition, additional information is provided to assist the user in determining the problem.

All input/output operations (i.e., OPEN, INQUIRE, REWIND, READ, WRITE, CLOSE) use the option "IOSTAT=IOS." If an error is encountered in such an operation, the variable IOS is provided. Since IOS is zero if no error condition exists, is a processor-dependent negative integer value if an end-of-file is encountered, and is a processor-dependent positive integer value if an error condition exists, the user should become familiar with the processor-dependent values for IOS to assist in evaluating any input/output error messages. If implemented, the FUNCTION IOERR should assist the user with appropriate error messages.

7.3 Warning Messages

A warning is a problem that MOSART encountered and recognized with either the input or values calculated from the input. However, the problem is not severe, and some type of corrective action can be taken. The warning message is provided at the terminal (UNIT=*) with a brief description of the error and the corrective action taken. Listed below in numerical order are the warning messages, together with the location of the message and suggested corrective action.

The user should read through these warning messages to become acquainted with the various choices MOSART and its utilities will make with respect to ambiguous input.

7.3.1 MOSART Warning Messages

```
Warning No. 1:  Spectral interval changed
                Old limits - XXXXXXXX.X to XXXXXXXX.X cm**-1
                New limits - XXXXXXXX.X to XXXXXXXX.X cm**-1
```

Location: DFLT8

Cause: The spectral limits specified by the user did not satisfy the limits and/or resolution of the code. The spectral interval was modified to satisfy the code requirements.

Action: Either accept the new limits or change the spectral limits and/or resolution in the input file.

```
Warning No. 2:  GEOM SUBROUTINE did not converge.  Error = XXXXX.XXXX km
```

Location: GEOM

Cause: If the user has specified the earth center angle or slant range between the observer and source instead of an elevation angle, subroutine GEOM will iteratively calculate the elevation angle between them. It uses the angle calculated to compute a ground or slant range. The calculated range is compared with the input angle or range, and the iteration stops when the difference (error) is less than 1 meter, or if more than 30 iterations have been completed. This warning message occurs when 30 iterations have been performed with the error still greater than 1 meter. For some very long (e.g., 800-1000 km), nearly horizontal paths, changes in the least significant bit of the DOUBLE PRECISION variable containing the elevation angle may result in differences in the slant range or earth center angle times the earth's radius (i.e., the ground range) of more than one meter, thereby producing this message.

Action: The user should check the input file. An unrealistic receiver-target geometry may have been specified. If the geometry is reasonable, contact Dr. William M. Cornette at (619) 455-9741 (e-mail: wmc@photon.com).

```
Warning No. 3:  Source angle not visible from sensor altitude
                Geometry removed from calculations.
```

Location: INIGEO

Cause: The observer cannot see the source with the specified geometry. In some rare cases, anomalous refraction (e.g., ducting) may be the cause.

Action: Check the specified geometry.

```
Warning No. 4:  Altitude difference of X.XXXXE+XX km is greater
                than slant range of    X.XXXXE+XX km
                Geometry removed from calculations.
```

Location: INIGEO

Cause: The specified altitudes are not compatible with the specified slant range.

Action: Specify the correct altitudes and slant range. If the slant range is equal to the altitude difference, numerical rounding in the computer may also cause this message to appear. In this case, either specify the elevation angle (either plus or minus 90 degrees) or make the slant range slightly greater than the altitude difference (e.g., 10.001 km for a altitude difference of 10.000 km).

```
Warning No. 5:  Illegal geometry in GEOM
                Specified final altitude was  XXXXXXX.XX km
                Calculated final geometry was XXXXXXX.XX km
                Geometry removed from calculations.
```

Location: GEOM

Cause: The ray in GEOM is supposed to terminate at a specified point in the altitude array. It did not.

Action: Check geometry inputs carefully.

```
Warning No. 6:  Observer-source path terminated
                Background type NNNNN did not match with type NNNNN
                Geometry removed from calculation.
```

Location: CALCUL

Cause: The background (ray terminator) type encountered by the ray was not the type originally specified background type. For example, if the ray parameters were improperly defined, the ray might strike the ground prior to reaching the source. However, when the source is beyond the horizon, Warning Message No. 8 is usually encountered.

Action: Check the specified geometry.

```
Warning No. 7:  Atmospheric file band is   XXXXXXXX.X to XXXXXXXX.X
                Spectral band requested is XXXXXXXX.X to XXXXXXXX.X
                Spectral band is truncated.
```

Location: SUMFIL

Cause: One or both of the requested spectral limits exceeds the spectral region of the existing data file. This warning occurs only when an existing binary data file is being summarized by MRFLTR.

Action: Accept the truncation, re-summarize the existing binary data file over the proper spectral interval, or create a new binary data file for the desired spectral interval.

```
Warning No. 8:  Requested range is beyond horizon
                Requested slant  range = XXXXXXX.XX but horizon = XXXXXXX.XX
                Requested ground range = XXXXXXX.XX but horizon = XXXXXXX.XX
                Geometry removed from calculation.
```

Location: HORIZN

Cause: The observer can't see the source.

Action: Specify a proper geometry.

```
Warning No. 9:  There were no fields in string.
                String (1-4): 'AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA'
                Value of FFFF was returned.
```

Location: GETVEC

Cause: The input file contained no entries for a multiple input.

Action: Make sure all multiple inputs contain at least one value in the input file, or accept the value returned.

```
Warning No. 10:  The multiple scattering iteration did not converge.
                 Wavenumber = XXXXXXX.XX cm**-1
                 Maximum relative error = X.XXXXE+XX
                 Type                   = (Thermal or Solar)
```

Location: COUPLE

Cause: Convergence in the multiple scattering coupling routine did not converge to a relative error of 1.00E-06 after up and down passes through the atmospheric layers.

Action: Please note that the convergence criteria is fairly severe. If the relative error is unacceptable, call Dr. William M. Cornette at (619) 455-9741 (e-mail: wmc@photon.com). If necessary, increase the number of iterations in COUPLE.

```
Warning No. 11:  Potential lunar eclipse
```

Location: EPHEMS

Cause: The ephemeris calculations have determined that the geometry for a lunar eclipse may exist.

Action: Accept the condition or change the time slightly.

```
Warning No. 12:  Potential solar eclipse
```

Location: EPHEMS

Cause: The ephemeris calculations have determined that the geometry for a solar eclipse may exist.

Action: Accept the condition or change the time slightly.

```
Warning No. 13:  Wind speed is beyond 30 m/s.  Radiative properties of the
                 Desert aerosol have been extrapolated.
```

Location: DESAER

Cause: The Desert Aerosol Model was selected with a wind speed greater than 30 m/sec. This is beyond the set of wind speeds for which the data base was developed.

Action: Accept the extrapolation or use a wind speed below 30 m/sec.

```
Warning No. 14: There were no fields in string.
                String (1-40): 'AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA'
                Value of IIIII was returned.
```

Location: IGTVEC

Cause: The input file contained no entries for a multiple input.

Action: Make sure all multiple inputs contain at least one value in the input file, or accept the value returned.

```
Warning No. 15:  The particle size distribution contains only XX.XX% of
                 the particles.  Either the particle size limits or the
                 number of intervals should be changed.
```

Location: MIEPHS

Cause: The numerical integral of the particle size distribution for the user-defined aerosol differed from 1.00 by greater than 0.01.

Action: Either increase the lower and/or upper bounds of the size distribution or increase the number of integration steps.

```
Warning No. 16:  Observer altitude less than background altitude
                 Observer altitude no. NNNNN reset to XXXXXX.XXX km
```

Location: INITL

Cause: The user-supplied observer altitude was less than either the user-supplied or code calculated background altitude. This is most likely to occur when the global background option calculates the background altitude.

Action: Accept that the observer altitude is reset to the background altitude as indicated, or redefine the observer altitude.

```
Warning No. 17:  Source altitude less than background altitude
                 Source altitude no. NNNNN reset to XXXXXX.XXX km
```

Location: INITL

Cause: The user-supplied source altitude was less than either the user-supplied or code calculated background altitude. This is most likely to occur when the global background option calculates the background altitude.

Action: Accept that the source altitude is reset to the background altitude as indicated, or redefine the source altitude.

```
Warning No. 18:  A relative humidity of XXX.XXXXE+XX at an altitude of
                 XXXXXXX.XX km is not allowed.  Water vapor value
                 changed to 99%.
```

Location: EQABS

Cause: The combination of temperature and water vapor concentration at some altitude provides a relative humidity relative to water (not ice) greater than 100%. Since supersaturation of water is rare in a stable atmosphere, the water vapor concentration is set equal to 99% relative humidity. This message occurs when (1) the temperature and water vapor concentration profiles are mixed using M1 and M2; (2) the global option sets the boundary layer temperature to the global, seasonal, and temporal value; or (3) a user-defined profile of either temperature and/or water vapor concentration is input.

Action: Either accept the change or redefine either the temperature, the water vapor concentration, or both.

```
Warning No. 19:  Earth/skyshine calculations not allowed.
                 Observer reference frame used.
```

Location: INITL

Cause: Earth/skyshine calculations are a source-centered set of geometries. If the user requested an observer reference frame, the determination of the earth/skyshine geometries is not allowed.

Action: Either change the reference frame to a source-centered one, or accept that no earth/skyshine calculations have been made.

```
Warning No. 20:  Cloud etages below ground level.
                 Reset cloud etages to be above ground.
                 Low etage cloud base  = FFFFFFF.FF km and top = FFFFFFF.FF km
                 Mid etage cloud base  = FFFFFFF.FF km and top = FFFFFFF.FF km
                 High etage cloud base = FFFFFFF.FF km and top = FFFFFFF.FF km
```

Location: GETBCK

Cause: Most likely, this will occur with a global background model, where the code selects the background, but the user specifies the cloud altitudes.

Action: Accept the new cloud altitudes or input altitudes that are compatible with the background altitude.

```
Warning No. 21:  There were no fields in string.
                 String (1-40): AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
                 A single blank field was returned.
```

Location: PARSE

Cause: For a tabular input record or a multiple input record, no fields were encountered.

Action: Accept the blank field or modify the input file.

```
Warning No. 22:  Temperature (FFFFFFF.FF deg C.) is out of range.
```

Location: CIREX

Cause: The temperature of the cirrus cloud did not fall within the acceptable temperature range for the model.

Action: Accept that the values used for the extinction coefficient are based on the closest available value within the temperature range from -20 deg. C to -60 deg. C.

```
Warning No. 23:  Temperature calculation did not converge.
                 Remaining flux = FFFFFF.FFF w/m**2
```

Location: HTBLNC

Cause: The diurnal iteration calculation for the terrain material temperature did not converge.

Action: Accept the temperature error or increase the number of iterations.

```
Warning No. 24:  Solar/lunar geometry problems NNNNN
```

Location: SLPOS

Cause: An error was encountered in SUBROUTINE GEOM in determining the impact of refraction on the solar or lunar position.

Action: Refer to SUBROUTINE GEOM to identify the value of IERR (NNNNN) that is returned. Call Dr. William M. Cornette at (619) 455-9741 (e-mail: wmc@photon.com).

```
Warning No. 25:  Global data base file not installed.
                 Default values used.
```

Location: RDGBL

Cause: MOSART cannot find the global data base.

Action: If the data base was installed correctly and is expected to be used, check the file name.

```
Warning No. 26:  Scenes data base file not installed.
                 Default values used.
```

Location: RDSCN

Cause: MOSART cannot find the scenes data base.

Action: If the data base was installed correctly and is expected to be used, check the file name.

7.3.2 CRFILE Warning Messages

```
Warning No. 1:  MOSART will not permit cycling on whole file.
                First set only used.
```

Location: RDMDTN

Cause: The multiple atmospheric characterization in a MODTRAN input file is not allowed in MOSART.

Action: Accept the first atmospheric characterization for the MOSART file. If the others are desired, create additional MOSART files.

```
Warning No. 2:  MOSART will not allow NNNN spectral bins.
                The first NNNNN spectral bins are used.
```

Location: RDMDTN

Cause: The MODTRAN input file contained too many spectral bins for MOSART.

Action: Accept the MOSART file with fewer spectral bins or increase the number of allowed spectral bins in MOSART (set by parameter NVSMAX) or create additional MOSART files.

```
Warning No. 3:  MOSART will not allow NNNN geometries.
                The first NNNNN geometries are used.
```

Location: RDMDTN

Cause: The MODTRAN input file contained too many geometries for MOSART.

Action: Accept the MOSART file with fewer geometries or increase the number of allowed geometries in MOSART (set by parameter NGMAX) or create additional MOSART files.

```
Warning No.4:  The model atmosphere (NN) and the haze season (NN) are
               incompatible.  The haze season will be changed to match
               the model atmosphere.
```

Location: RDMDTN

Cause: The MOSART code requires that the model atmosphere season and the haze profile season match.

Action: No remedy.

7.3.3 MRFLTR Warning Messages

```
Warning No. 1A:  Spectral interval changed
                 Old limits - XXXXXXXX.X to XXXXXXXX.X cm**-1
                 New limits - XXXXXXXX.X to XXXXXXXX.X cm**-1
```

Location: ATMOUT

Cause: Refer to MOSART Warning No. 1

Action: Refer to MOSART Warning No. 1

APPENDIX A: SAMPLE MOSART OUTPUT FILE (LONG OPTION)

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

************************   Atmospheric Profile Data    ************************

Layer  Altitude   Pressure    Temperature  Relative     Structure  Structure
 No.     (km)       (mb)          (K)      Humidity      Constant     Length
                                           (percent)   (m**(-2/3))     (m)

  1  0.000E+00   1013.          304.58       64.6       0.00E+00     0.000
                 1013.          294.20       76.0       0.00E+00     0.000
                 1010.          287.20       75.1       0.00E+00     0.000
-------------------------------- Ground Level --------------------------------
  2  0.487        958.9         300.20       63.0       9.92E-15     1.438
                  957.6         292.01       70.7       9.92E-15     1.216
                  952.8         284.52       72.4       9.93E-15     1.192
  3    1.00       904.6         295.59       61.8       3.65E-16     0.264
                  902.0         289.70       65.8       2.38E-16     0.191
                  896.0         281.70       69.9       1.14E-16     0.129
  4    1.23       880.3         294.18       61.4       1.28E-16     0.154
                  877.6         288.65       63.0       9.19E-17     0.122
                  870.8         280.44       69.8       6.27E-17     0.097
  5    1.50       853.4         292.58       61.0       7.15E-17     0.118
                  850.5         287.45       60.0       6.09E-17     0.102
                  842.9         279.00       69.7       4.90E-17     0.088
  6    1.73       830.5         291.17       60.7       5.78E-17     0.108
                  827.5         286.40       57.6       5.16E-17     0.096
                  819.1         277.74       69.7       4.15E-17     0.083
  7    2.00       805.1         289.56       60.5       4.98E-17     0.102
                  802.0         285.20       55.0       4.44E-17     0.092
                  792.9         276.30       69.8       3.44E-17     0.078
------------------------------- Boundary Layer -------------------------------
  8    2.48       760.0         286.75       49.8       3.97E-17     0.093
                  756.0         282.29       49.8       3.42E-17     0.084
                  746.4         273.68       67.3       2.45E-17     0.068
  9    2.80       732.1         284.92       44.0       3.43E-17     0.089
                  727.6         280.40       46.9       2.90E-17     0.080
                  717.7         271.98       65.9       1.97E-17     0.062
 10    2.87       725.7         284.49       42.8       3.32E-17     0.089
                  721.1         279.97       46.2       2.79E-17     0.080
                  711.2         271.59       65.6       1.87E-17     0.062
 11    3.00       714.8         283.75       40.7       3.13E-17     0.087
                  710.0         279.20       45.1       2.60E-17     0.078
                  700.0         270.90       65.1       1.71E-17     0.059
 12    3.24       694.7         282.37       38.5       2.81E-17     0.084
                  689.8         277.79       43.5       2.30E-17     0.075
                  679.3         269.63       63.8       1.46E-17     0.056
 13    3.60       664.7         280.23       35.4       2.38E-17     0.079
                  659.7         275.61       41.2       1.90E-17     0.070
                  648.4         267.67       62.1       1.16E-17     0.051
 14    3.74       653.8         279.43       34.3       2.23E-17     0.078
                  648.7         274.79       40.4       1.77E-17     0.068
                  637.2         266.93       61.5       1.07E-17     0.050
 15    3.74       653.0         279.37       34.2       2.23E-17     0.079
                  648.0         274.73       40.3       1.76E-17     0.069
                  636.4         266.88       61.5       1.06E-17     0.050
 16    4.00       633.1         277.87       32.3       1.98E-17     0.075
                  628.0         273.20       38.9       1.54E-17     0.065
                  616.0         265.50       60.4       9.30E-18     0.047
 17    4.10       625.4         277.31       32.2       1.89E-17     0.073
                  620.3         272.61       38.1       1.47E-17     0.064
                  608.2         264.97       59.7       8.89E-18     0.047
 18    4.24       614.2         276.48       32.0       1.77E-17     0.073
                  609.0         271.73       36.8       1.36E-17     0.063
                  596.7         264.18       58.5       8.39E-18     0.047
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

*********************** Atmospheric Profile Data ***********************

Layer No.	Altitude (km)	Pressure (mb)	Temperature (K)	Relative Humidity (percent)	Structure Constant (m**(-2/3))	Structure Length (m)
19	5.00	559.3	272.20	31.3	1.28E-17	0.064
		554.0	267.20	31.3	9.68E-18	0.055
		541.0	260.10	53.4	7.76E-18	0.048
20	5.25	541.9	270.78	30.9	1.15E-17	0.064
		536.5	265.70	30.9	8.85E-18	0.055
		523.4	258.35	52.5	8.21E-18	0.053
21	6.00	492.9	266.52	29.8	8.88E-18	0.060
		487.0	261.20	29.9	7.64E-18	0.053
		474.0	253.10	50.4	1.13E-17	0.064
22	6.29	474.8	264.48	29.4	8.26E-18	0.060
		468.5	259.32	29.9	7.66E-18	0.055
		455.5	251.07	49.8	1.30E-17	0.070
23	6.32	472.7	264.24	29.3	8.20E-18	0.060
		466.4	259.10	30.0	7.68E-18	0.055
		453.4	250.84	49.8	1.32E-17	0.071
24	6.40	468.0	263.70	29.2	8.08E-18	0.061
		461.6	258.60	30.0	7.74E-18	0.057
		448.5	250.29	49.6	1.37E-17	0.074
25	6.90	438.7	260.18	28.7	7.64E-18	0.061
		431.7	255.35	30.2	8.52E-18	0.061
		418.7	246.79	49.1	1.73E-17	0.086
26	7.00	433.1	259.48	28.6	7.62E-18	0.063
		426.0	254.70	30.3	8.76E-18	0.065
		413.0	246.10	49.1	1.81E-17	0.091
27	8.00	379.1	252.41	27.2	8.67E-18	0.069
		372.0	248.20	29.6	1.24E-17	0.081
		359.0	239.20	41.1	2.53E-17	0.112
28	8.33	362.2	250.07	26.5	9.48E-18	0.076
		355.2	246.03	29.6	1.41E-17	0.091
		342.1	236.86	33.9	2.74E-17	0.123
29	8.83	338.3	246.56	25.6	1.11E-17	0.085
		331.5	242.78	29.9	1.68E-17	0.103
		318.3	233.36	25.7	2.99E-17	0.133
30	8.91	334.7	246.02	25.5	1.13E-17	0.088
		328.0	242.28	30.0	1.72E-17	0.107
		314.8	232.82	24.6	3.02E-17	0.137
31	9.00	330.7	245.40	25.4	1.17E-17	0.090
		324.0	241.70	30.1	1.78E-17	0.109
		310.8	232.20	23.5	3.05E-17	0.139
32	9.41	312.1	242.52	24.0	1.33E-17	0.099
		305.6	239.07	29.6	2.01E-17	0.119
		292.3	229.32	18.9	3.17E-17	0.145
----------			Tropopause No. 3/1		----------	
33	10.0	287.3	238.39	22.3	1.60E-17	0.115
		281.0	235.30	29.3	2.34E-17	0.137
		267.7	225.20	14.0	3.23E-17	0.143
34	11.0	248.6	231.39	15.1	2.09E-17	0.141
		243.0	228.80	19.3	2.82E-17	0.162
		230.0	225.20	3.8	3.07E-17	0.146
35	12.0	214.1	224.42	9.2	2.56E-17	0.170
		209.0	222.30	10.6	3.13E-17	0.187
		197.7	225.20	1.5	2.70E-17	0.160
----------			Tropopause No. 2/1		----------	
36	13.0	183.6	217.46	5.2	2.92E-17	0.199
		179.0	215.80	5.3	3.23E-17	0.193
		170.0	225.20	0.9	2.21E-17	0.168

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************************ Atmospheric Profile Data ************************

Layer No.	Altitude (km)	Pressure (mb)	Temperature (K)	Relative Humidity (percent)	Structure Constant (m**(-2/3))	Structure Length (m)
37	14.0	156.6	210.50	6.5	3.15E-17	0.227
		153.0	215.70	2.9	3.06E-17	0.200
		146.0	225.20	0.7	1.70E-17	0.173
------------------------------ Tropopause No. 1/1 ------------------------------						
38	15.0	132.9	203.54	8.8	3.23E-17	0.234
		130.0	215.70	1.7	2.65E-17	0.218
		126.0	225.20	0.6	1.25E-17	0.171
39	16.0	112.5	203.15	7.2	3.05E-17	0.239
		111.0	215.70	1.4	2.13E-17	0.233
		108.0	225.20	0.5	8.76E-18	0.165
40	17.0	95.25	205.20	4.5	2.62E-17	0.259
		95.00	215.70	1.1	1.61E-17	0.235
		92.80	225.20	0.5	5.91E-18	0.159
41	18.0	80.81	207.38	2.8	2.08E-17	0.272
		81.20	216.80	0.8	1.15E-17	0.230
		79.80	225.20	0.4	3.85E-18	0.150
42	19.0	67.87	209.57	1.8	1.54E-17	0.288
		69.50	217.90	0.6	7.84E-18	0.224
		68.60	225.20	0.4	2.43E-18	0.138
43	20.0	58.46	211.75	1.2	1.08E-17	0.298
		59.50	219.20	0.5	5.13E-18	0.214
		59.00	225.20	0.3	1.49E-18	0.126
44	21.0	49.86	213.93	0.8	7.23E-18	0.283
		51.00	220.40	0.4	3.23E-18	0.200
		50.70	225.20	0.3	8.95E-19	0.113
45	22.0	42.58	215.94	0.6	4.62E-18	0.271
		43.70	221.60	0.3	1.97E-18	0.185
		43.60	225.20	0.3	5.24E-19	0.101
46	23.0	36.43	217.92	0.4	2.84E-18	0.253
		37.60	222.80	0.2	1.17E-18	0.167
		37.50	225.20	0.2	3.01E-19	0.088
47	24.0	31.21	219.90	0.3	1.69E-18	0.232
		32.20	223.90	0.2	6.75E-19	0.149
		32.28	226.60	0.2	1.69E-19	0.076
48	25.0	26.77	221.88	0.2	9.76E-19	0.217
		27.70	225.10	0.1	3.81E-19	0.137
		27.80	228.10	0.1	9.37E-20	0.069
49	27.5	18.36	226.84	0.1	2.21E-19	0.149
		19.07	228.45	0.1	8.30E-20	0.090
		19.23	231.00	0.1	2.00E-20	0.045
50	30.0	12.70	231.79	0.0	4.37E-20	0.100
		13.20	233.70	0.0	1.62E-20	0.060
		13.40	235.10	0.0	3.91E-21	0.030
51	32.5	8.858	236.89	0.0	7.78E-21	0.063
		9.300	239.00	0.0	2.91E-21	0.038
		9.400	240.00	0.0	7.15E-22	0.018
52	35.0	6.229	242.77	0.0	1.27E-21	0.038
		6.520	245.20	0.0	4.83E-22	0.023
		6.610	247.20	0.0	1.23E-22	0.011
53	37.5	4.421	248.70	0.0	1.92E-22	0.025
		4.640	251.30	0.0	7.53E-23	0.013
		4.720	254.60	0.0	2.01E-23	0.007
54	40.0	3.612	254.62	0.0	2.73E-23	0.012
		3.330	257.50	0.0	1.11E-23	0.007
		3.400	262.10	0.0	3.15E-24	0.004

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*********************** Atmospheric Profile Data ***********************

Layer No.	Altitude (km)	Pressure (mb)	Temperature (K)	Relative Humidity (percent)	Structure Constant (m**(-2/3))	Structure Length (m)
55	42.5	2.281	260.53	0.0	3.69E-24	0.005
		2.410	263.70	0.0	1.57E-24	0.004
		2.480	269.50	0.0	4.74E-25	0.002
56	45.0	1.657	266.44	0.0	4.74E-25	0.003
		1.760	269.90	0.0	2.12E-25	0.002
		1.820	273.60	0.0	6.90E-26	0.001
57	47.5	1.213	271.66	0.0	5.87E-26	0.002
		1.290	275.20	0.0	2.77E-26	0.001
		1.340	276.20	0.0	9.72E-27	0.001
-----			Stratopause	No. 1/1	-----	
-----			Stratopause	No. 2/1	-----	
-----			Stratopause	No. 3/1	-----	
58	50.0	0.8908	272.15	0.0	7.00E-27	0.001
		0.9510	275.70	0.0	3.50E-27	0.001
		0.9870	277.20	0.0	1.33E-27	0.000
59	55.0	0.4782	265.24	0.0	9.07E-29	0.000
		0.5150	269.30	0.0	5.14E-29	0.000
		0.5370	274.00	0.0	2.33E-29	0.000
60	60.0	0.2512	254.79	0.0	1.06E-30	0.000
		0.2720	257.10	0.0	6.86E-31	0.000
		0.2880	262.70	0.0	3.75E-31	0.000
61	65.0	0.1271	236.19	0.0	1.14E-32	0.000
		0.1390	240.10	0.0	8.48E-33	0.000
		0.1470	239.70	0.0	5.64E-33	0.000
62	70.0	6.0830E-02	217.61	0.0	1.14E-34	0.000
		6.7000E-02	218.10	0.0	9.84E-35	0.000
		7.1000E-02	216.60	0.0	8.00E-35	0.000
63	75.0	2.7310E-02	199.06	0.0	0.00E+00	0.000
		3.0000E-02	196.10	0.0	0.00E+00	0.000
		3.2000E-02	193.60	0.0	0.00E+00	0.000
64	80.0	1.1350E-02	180.54	0.0	0.00E+00	0.000
		1.2000E-02	174.10	0.1	0.00E+00	0.000
		1.2500E-02	170.60	0.1	0.00E+00	0.000
65	85.0	4.3730E-03	172.49	0.0	0.00E+00	0.000
		4.4800E-03	165.10	0.1	0.00E+00	0.000
		4.5100E-03	161.70	0.2	0.00E+00	0.000
-----			Mesopause	No. 1/1	-----	
-----			Mesopause	No. 2/1	-----	
-----			Mesopause	No. 3/1	-----	
66	90.0	1.6710E-03	172.43	0.0	0.00E+00	0.000
		1.6400E-03	165.00	0.0	0.00E+00	0.000
		1.6100E-03	161.60	0.0	0.00E+00	0.000
67	95.0	6.5750E-04	181.72	0.0	0.00E+00	0.000
		6.2500E-04	178.30	0.0	0.00E+00	0.000
		6.0600E-04	176.80	0.0	0.00E+00	0.000
68	100.	2.7370E-04	190.03	0.0	0.00E+00	0.000
		2.5800E-04	190.50	0.0	0.00E+00	0.000
		2.4800E-04	190.40	0.0	0.00E+00	0.000
69	105.	1.2330E-04	216.32	0.0	0.00E+00	0.000
		1.1700E-04	222.20	0.0	0.00E+00	0.000
		1.1300E-04	226.00	0.0	0.00E+00	0.000
70	110.	6.2760E-05	251.74	0.0	0.00E+00	0.000
		6.1100E-05	262.40	0.0	0.00E+00	0.000
		6.0000E-05	270.10	0.0	0.00E+00	0.000
71	115.	3.5800E-05	308.22	0.0	0.00E+00	0.000
		3.5600E-05	316.80	0.0	0.00E+00	0.000
		3.5400E-05	322.70	0.0	0.00E+00	0.000
72	120.	2.2600E-05	380.00	0.0	0.00E+00	0.000
		2.2700E-05	380.00	0.0	0.00E+00	0.000
		2.2600E-05	380.00	0.0	0.00E+00	0.000

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Layer No.	Altitude (km)	Pressure (mb)	Temperature (K)	Relative Humidity (percent)	Structure Constant (m**(-2/3))	Structure Length (m)
73	130.	1.2505E-05	469.27	0.0	0.00E+00	0.000
		1.2505E-05	469.27	0.0	0.00E+00	0.000
		1.2505E-05	469.27	0.0	0.00E+00	0.000
74	150.	4.5420E-06	634.39	0.0	0.00E+00	0.000
		4.5420E-06	634.39	0.0	0.00E+00	0.000
		4.5420E-06	634.39	0.0	0.00E+00	0.000
75	200.	8.4740E-07	854.56	0.0	0.00E+00	0.000
		8.4740E-07	854.56	0.0	0.00E+00	0.000
		8.4740E-07	854.56	0.0	0.00E+00	0.000
76	250.	2.4770E-07	941.33	0.0	0.00E+00	0.000
		2.4770E-07	941.33	0.0	0.00E+00	0.000
		2.4770E-07	941.33	0.0	0.00E+00	0.000
77	400.	1.7615E-08	976.08	0.0	0.00E+00	0.000
		1.7615E-08	976.08	0.0	0.00E+00	0.000
		1.7615E-08	976.08	0.0	0.00E+00	0.000
78	500.	3.0236E-09	999.24	0.0	0.00E+00	0.000
		3.0236E-09	999.24	0.0	0.00E+00	0.000
		3.0236E-09	999.24	0.0	0.00E+00	0.000
79	1.000E+03	7.5140E-11	1000.00	0.0	0.00E+00	0.000
		7.5140E-11	1000.00	0.0	0.00E+00	0.000
		7.5140E-11	1000.00	0.0	0.00E+00	0.000
80	1.001E+03	0.0000E+00	1000.00	0.0	0.00E+00	0.000
		0.0000E+00	1000.00	0.0	0.00E+00	0.000
		0.0000E+00	1000.00	0.0	0.00E+00	0.000
81	1.000E+05	0.0000E+00	1000.00	0.0	0.00E+00	0.000
		0.0000E+00	1000.00	0.0	0.00E+00	0.000
		0.0000E+00	1000.00	0.0	0.00E+00	0.000
82	3.736E+05	0.0000E+00	1000.00	0.0	0.00E+00	0.000
		0.0000E+00	1000.00	0.0	0.00E+00	0.000
		0.0000E+00	1000.00	0.0	0.00E+00	0.000
83	1.490E+08	0.0000E+00	1000.00	0.0	0.00E+00	0.000
		0.0000E+00	1000.00	0.0	0.00E+00	0.000
		0.0000E+00	1000.00	0.0	0.00E+00	0.000

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****************** Aerosol/Hydrometeor Profile Data ******************

Layer No.	Altitude (km)	Aerosol Type	Aerosol Extinction (km**-1)	Cloud Density Water (gm/m**3)	Cloud Density Ice (gm/m**3)	Cloud Type	Precip. Rate Rain --(mm/hr)---	Precip. Rate Snow --(mm/hr)---
1	0.000E+00	Rural	0.00E+00	0.00E+00	0.00E+00		0.00	0.00
		Rural	0.00E+00		0.00E+00			
		Rural	0.00E+00		0.00E+00			
------------	------------	------------	Ground Level	------------	------------	------------	------------	------------
2	0.487	Rural	1.96E-01	0.00E+00	0.00E+00		0.00	0.00
		Rural	2.24E-01		0.00E+00			
		Rural	2.21E-01		0.00E+00			
3	1.00	Rural	1.55E-01	0.00E+00	0.00E+00		0.00	0.00
		Rural	1.70E-01		0.00E+00			
		Rural	1.58E-01		0.00E+00			
4	1.23	Rural	1.39E-01	0.00E+00	0.00E+00		0.00	0.00
		Rural	1.50E-01		0.00E+00			
		Rural	1.35E-01		0.00E+00			
5	1.50	Rural	1.23E-01	0.00E+00	0.00E+00		0.00	0.00
		Rural	1.30E-01		0.00E+00			
		Rural	1.14E-01		0.00E+00			
6	1.73	Rural	1.11E-01	0.00E+00	0.00E+00		0.00	0.00
		Rural	1.15E-01		0.00E+00			
		Rural	9.75E-02		0.00E+00			
7	2.00	Rural	9.83E-02	0.00E+00	0.00E+00		0.00	0.00
		Rural	9.97E-02		0.00E+00			
		Rural	8.18E-02		0.00E+00			
------------	------------	------------	Boundary Layer	------------	------------	------------	------------	------------
8	2.48	Troposph.	7.88E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	7.70E-02		0.00E+00			
		Troposph.	5.95E-02		0.00E+00			
9	2.80	Troposph.	6.83E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	6.50E-02		0.00E+00			
		Troposph.	4.84E-02		0.00E+00			
10	2.87	Troposph.	6.61E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	6.25E-02		0.00E+00			
		Troposph.	4.61E-02		0.00E+00			
11	3.00	Troposph.	6.24E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	5.84E-02		0.00E+00			
		Troposph.	4.24E-02		0.00E+00			
12	3.24	Troposph.	5.60E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	5.15E-02		0.00E+00			
		Troposph.	3.63E-02		0.00E+00			
13	3.60	Troposph.	4.75E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	4.24E-02		0.00E+00			
		Troposph.	2.86E-02		0.00E+00			
14	3.74	Troposph.	4.46E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	3.94E-02		0.00E+00			
		Troposph.	2.61E-02		0.00E+00			
15	3.74	Troposph.	4.44E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	3.92E-02		0.00E+00			
		Troposph.	2.60E-02		0.00E+00			
16	4.00	Troposph.	3.96E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	3.42E-02		0.00E+00			
		Troposph.	2.20E-02		0.00E+00			
17	4.10	Troposph.	3.78E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	3.24E-02		0.00E+00			
		Troposph.	2.06E-02		0.00E+00			
18	4.24	Troposph.	3.54E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	3.00E-02		0.00E+00			
		Troposph.	1.87E-02		0.00E+00			

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******************* Aerosol/Hydrometeor Profile Data *******************

Layer No.	Altitude (km)	Aerosol Type	Aerosol Extinction (km**-1)	Cloud Density Water (gm/m**3)	Cloud Density Ice (gm/m**3)	Cloud Type	Precip. Rate Rain --(mm/hr)---	Precip. Rate Snow --(mm/hr)---
19	5.00	Troposph.	2.51E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	2.00E-02		0.00E+00			
		Troposph.	1.14E-02		0.00E+00			
20	5.25	Troposph.	2.24E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.75E-02		0.00E+00			
		Troposph.	9.65E-03		0.00E+00			
21	6.00	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
22	6.29	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
23	6.32	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
24	6.40	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
25	6.90	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
26	7.00	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
27	8.00	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
28	8.33	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
29	8.83	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
30	8.91	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
31	9.00	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
32	9.41	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Troposph.	8.12E-03		0.00E+00			
---------------------------- Tropopause No. 3/1 ----------------------------								
33	10.0	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Bk.Strat 1	1.14E-03		0.00E+00			
34	11.0	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Bk.Strat 1	9.69E-04		0.00E+00			
35	12.0	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Troposph.	1.17E-02		0.00E+00			
		Bk.Strat 1	7.99E-04		0.00E+00			
---------------------------- Tropopause No. 2/1 ----------------------------								
36	13.0	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	1.14E-03		0.00E+00			
		Bk.Strat 1	7.20E-04		0.00E+00			

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****************** Aerosol/Hydrometeor Profile Data ******************

Layer No.	Altitude (km)	Aerosol Type	Aerosol Extinction (km**-1)	Cloud Density Water (gm/m**3)	Cloud Density Ice (gm/m**3)	Cloud Type	Precip. Rate Rain --(mm/hr)---	Precip. Rate Snow --(mm/hr)---
37	14.0	Troposph.	1.59E-02	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	9.56E-04		0.00E+00			
		Bk.Strat 1	6.41E-04		0.00E+00			
------------------------------ Tropopause No. 1/1 ---------------------------								
38	15.0	Bk.Strat 1	1.14E-03	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	7.86E-04		0.00E+00			
		Bk.Strat 1	5.79E-04		0.00E+00			
39	16.0	Bk.Strat 1	9.45E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	7.01E-04		0.00E+00			
		Bk.Strat 1	5.17E-04		0.00E+00			
40	17.0	Bk.Strat 1	7.76E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	6.21E-04		0.00E+00			
		Bk.Strat 1	4.79E-04		0.00E+00			
41	18.0	Bk.Strat 1	6.86E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	5.54E-04		0.00E+00			
		Bk.Strat 1	4.42E-04		0.00E+00			
42	19.0	Bk.Strat 1	6.06E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	4.99E-04		0.00E+00			
		Bk.Strat 1	4.18E-04		0.00E+00			
43	20.0	Bk.Strat 1	5.35E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	4.58E-04		0.00E+00			
		Bk.Strat 1	3.95E-04		0.00E+00			
44	21.0	Bk.Strat 1	4.85E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	4.27E-04		0.00E+00			
		Bk.Strat 1	3.88E-04		0.00E+00			
45	22.0	Bk.Strat 1	4.42E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	4.01E-04		0.00E+00			
		Bk.Strat 1	3.82E-04		0.00E+00			
46	23.0	Bk.Strat 1	4.15E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	3.90E-04		0.00E+00			
		Bk.Strat 1	4.03E-04		0.00E+00			
47	24.0	Bk.Strat 1	3.93E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	3.83E-04		0.00E+00			
		Bk.Strat 1	4.25E-04		0.00E+00			
48	25.0	Bk.Strat 1	3.86E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	4.03E-04		0.00E+00			
		Bk.Strat 1	4.72E-04		0.00E+00			
49	27.5	Bk.Strat 1	4.39E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	5.05E-04		0.00E+00			
		Bk.Strat 1	5.66E-04		0.00E+00			
50	30.0	Bk.Strat 1	5.55E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	5.83E-04		0.00E+00			
		Bk.Strat 1	5.89E-04		0.00E+00			
51	32.5	Bk.Strat 1	5.89E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	5.42E-04		0.00E+00			
		Bk.Strat 1	4.81E-04		0.00E+00			
52	35.0	Bk.Strat 1	4.67E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	4.29E-04		0.00E+00			
		Bk.Strat 1	3.60E-04		0.00E+00			
53	37.5	Bk.Strat 1	3.17E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	2.75E-04		0.00E+00			
		Bk.Strat 1	2.23E-04		0.00E+00			
54	40.0	Bk.Strat 1	1.79E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	1.58E-04		0.00E+00			
		Bk.Strat 1	1.31E-04		0.00E+00			

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******************* Aerosol/Hydrometeor Profile Data ********************

Layer No.	Altitude (km)	Aerosol Type	Aerosol Extinction (km**-1)	Cloud Density Water (gm/m**3)	Cloud Density Ice (gm/m**3)	Cloud Type	Precip. Rate Rain --(mm/hr)---	Precip. Rate Snow --(mm/hr)---
55	42.5	Bk.Strat 1	1.17E-04	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	1.12E-04		0.00E+00			
		Bk.Strat 1	1.07E-04		0.00E+00			
56	45.0	Bk.Strat 1	8.91E-05	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	8.61E-05		0.00E+00			
		Bk.Strat 1	8.21E-05		0.00E+00			
57	47.5	Bk.Strat 1	6.11E-05	0.00E+00	0.00E+00		0.00	0.00
		Bk.Strat 1	5.96E-05		0.00E+00			
		Bk.Strat 1	5.77E-05		0.00E+00			
---------------------------- Stratopause No. 1/1 ----------------------------								
---------------------------- Stratopause No. 2/1 ----------------------------								
---------------------------- Stratopause No. 3/1 ----------------------------								
58	50.0	Met. Dust	3.32E-05	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	3.32E-05		0.00E+00			
		Met. Dust	3.32E-05		0.00E+00			
59	55.0	Met. Dust	1.64E-05	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	1.64E-05		0.00E+00			
		Met. Dust	1.64E-05		0.00E+00			
60	60.0	Met. Dust	7.99E-06	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	7.99E-06		0.00E+00			
		Met. Dust	7.99E-06		0.00E+00			
61	65.0	Met. Dust	4.01E-06	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	4.01E-06		0.00E+00			
		Met. Dust	4.01E-06		0.00E+00			
62	70.0	Met. Dust	2.10E-06	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	2.10E-06		0.00E+00			
		Met. Dust	2.10E-06		0.00E+00			
63	75.0	Met. Dust	1.61E-06	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	1.61E-06		0.00E+00			
		Met. Dust	1.61E-06		0.00E+00			
64	80.0	Met. Dust	1.13E-06	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	1.13E-06		0.00E+00			
		Met. Dust	1.13E-06		0.00E+00			
65	85.0	Met. Dust	6.45E-07	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	6.45E-07		0.00E+00			
		Met. Dust	6.45E-07		0.00E+00			
---------------------------- Mesopause No. 1/1 ----------------------------								
---------------------------- Mesopause No. 2/1 ----------------------------								
---------------------------- Mesopause No. 3/1 ----------------------------								
66	90.0	Met. Dust	1.60E-07	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	1.60E-07		0.00E+00			
		Met. Dust	1.60E-07		0.00E+00			
67	95.0	Met. Dust	1.33E-07	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	1.33E-07		0.00E+00			
		Met. Dust	1.33E-07		0.00E+00			
68	100.	Met. Dust	1.07E-07	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	1.07E-07		0.00E+00			
		Met. Dust	1.07E-07		0.00E+00			
69	105.	Met. Dust	8.05E-08	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	8.05E-08		0.00E+00			
		Met. Dust	8.05E-08		0.00E+00			
70	110.	Met. Dust	5.40E-08	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	5.40E-08		0.00E+00			
		Met. Dust	5.40E-08		0.00E+00			
71	115.	Met. Dust	2.74E-08	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	2.74E-08		0.00E+00			
		Met. Dust	2.74E-08		0.00E+00			
72	120.	Met. Dust	9.31E-10	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	9.31E-10		0.00E+00			
		Met. Dust	9.31E-10		0.00E+00			

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****************** Aerosol/Hydrometeor Profile Data ******************

Layer No.	Altitude (km)	Aerosol Type	Aerosol Extinction (km**-1)	Cloud Density Water (gm/m**3)	Cloud Density Ice (gm/m**3)	Cloud Type	Precip. Rate Rain --(mm/hr)---	Precip. Rate Snow --(mm/hr)---
73	130.	Met. Dust	4.81E-10	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	4.81E-10		0.00E+00			
		Met. Dust	4.81E-10		0.00E+00			
74	150.	Met. Dust	2.03E-11	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	2.03E-11		0.00E+00			
		Met. Dust	2.03E-11		0.00E+00			
75	200.	Met. Dust	7.08E-14	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	7.08E-14		0.00E+00			
		Met. Dust	7.08E-14		0.00E+00			
76	250.	Met. Dust	1.34E-17	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	1.34E-17		0.00E+00			
		Met. Dust	1.34E-17		0.00E+00			
77	400.	Met. Dust	3.02E-21	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	3.02E-21		0.00E+00			
		Met. Dust	3.02E-21		0.00E+00			
78	500.	Met. Dust	5.04E-22	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	5.04E-22		0.00E+00			
		Met. Dust	5.04E-22		0.00E+00			
79	1.000E+03	Met. Dust	0.00E+00	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	0.00E+00		0.00E+00			
		Met. Dust	0.00E+00		0.00E+00			
80	1.001E+03	Met. Dust	0.00E+00	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	0.00E+00		0.00E+00			
		Met. Dust	0.00E+00		0.00E+00			
81	1.000E+05	Met. Dust	0.00E+00	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	0.00E+00		0.00E+00			
		Met. Dust	0.00E+00		0.00E+00			
82	3.736E+05	Met. Dust	0.00E+00	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	0.00E+00		0.00E+00			
		Met. Dust	0.00E+00		0.00E+00			
83	1.490E+08	Met. Dust	0.00E+00	0.00E+00	0.00E+00		0.00	0.00
		Met. Dust	0.00E+00		0.00E+00			
		Met. Dust	0.00E+00		0.00E+00			

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****************     Molecular Concentrations Profile Data     ****************

Layer Altitude   ------------ Molecular Concentrations (ppmv) -------------
                   H2O        CO2        O3         N2O        CO         CH4
                   O2         NO         SO2        NO2        NH3        HNO3
                   N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                   C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                   CCl4       N2O5

  1 0.000E+00     2.91E+04   3.49E+02   3.83E-02   3.05E-01   1.65E-01   1.75E+00
                  2.05E+05   2.94E-04   2.94E-04   2.25E-05   4.90E-04   4.90E-05
                  7.66E+05   1.37E-04   2.35E-04   9.80E-13   9.80E-13   5.88E-05
                  1.86E-05   1.18E-05   9.80E-13   5.64E-06   4.25E-07   9.80E-13
                  1.27E-04   2.37E-10
                  1.86E+04   3.53E+02   2.99E-02   3.08E-01   1.67E-01   1.77E+00
                  2.07E+05   2.97E-04   2.97E-04   2.28E-05   4.95E-04   4.95E-05
                  7.74E+05   1.39E-04   2.38E-04   9.91E-13   9.91E-13   5.95E-05
                  1.88E-05   1.19E-05   9.91E-13   5.70E-06   4.30E-07   9.91E-13
                  1.29E-04   2.40E-10
                  1.19E+04   3.56E+02   2.41E-02   3.10E-01   1.68E-01   1.78E+00
                  2.09E+05   2.99E-04   2.99E-04   2.29E-05   4.99E-04   4.99E-05
                  7.79E+05   1.40E-04   2.39E-04   9.98E-13   9.98E-13   5.99E-05
                  1.90E-05   1.20E-05   9.98E-13   5.74E-06   4.33E-07   9.98E-13
                  1.30E-04   2.41E-10

------------------------------- Ground Level --------------------------------
  2 0.487         2.33E+04   3.32E+02   4.01E-02   3.22E-01   1.63E-01   1.71E+00
                  2.06E+05   2.96E-04   2.83E-04   2.27E-05   4.93E-04   5.37E-05
                  7.70E+05   1.38E-04   2.37E-04   9.86E-13   9.86E-13   5.91E-05
                  1.87E-05   1.18E-05   9.86E-13   5.36E-06   9.30E-07   9.86E-13
                  1.28E-04   4.65E-10
                  1.60E+04   3.31E+02   3.15E-02   3.21E-01   1.64E-01   1.70E+00
                  2.08E+05   2.98E-04   2.85E-04   2.29E-05   4.97E-04   5.41E-05
                  7.76E+05   1.39E-04   2.38E-04   9.94E-13   9.94E-13   5.96E-05
                  1.89E-05   1.19E-05   9.94E-13   5.40E-06   9.37E-07   9.94E-13
                  1.29E-04   4.69E-10
                  1.02E+04   3.31E+02   2.65E-02   3.11E-01   1.65E-01   1.70E+00
                  2.09E+05   3.00E-04   2.87E-04   2.30E-05   5.00E-04   5.44E-05
                  7.81E+05   1.40E-04   2.40E-04   9.99E-13   9.99E-13   5.99E-05
                  1.90E-05   1.20E-05   9.99E-13   5.44E-06   9.43E-07   9.99E-13
                  1.30E-04   4.72E-10

  3   1.00        1.85E+04   3.34E+02   4.20E-02   3.23E-01   1.61E-01   1.72E+00
                  2.07E+05   2.97E-04   2.72E-04   2.28E-05   4.96E-04   5.91E-05
                  7.74E+05   1.39E-04   2.38E-04   9.91E-13   9.91E-13   5.94E-05
                  1.88E-05   1.19E-05   9.91E-13   5.08E-06   2.12E-06   9.91E-13
                  1.29E-04   9.45E-10
                  1.37E+04   3.32E+02   3.32E-02   3.22E-01   1.62E-01   1.71E+00
                  2.08E+05   2.99E-04   2.73E-04   2.29E-05   4.98E-04   5.94E-05
                  7.78E+05   1.39E-04   2.39E-04   9.96E-13   9.96E-13   5.97E-05
                  1.89E-05   1.20E-05   9.96E-13   5.11E-06   2.13E-06   9.96E-13
                  1.29E-04   9.50E-10
                  8.71E+03   3.31E+02   2.94E-02   3.11E-01   1.63E-01   1.71E+00
                  2.09E+05   3.00E-04   2.74E-04   2.30E-05   5.00E-04   5.97E-05
                  7.82E+05   1.40E-04   2.40E-04   1.00E-12   1.00E-12   6.00E-05
                  1.90E-05   1.20E-05   1.00E-12   5.13E-06   2.14E-06   1.00E-12
                  1.30E-04   9.55E-10
```

4	1.23	1.73E+04	3.34E+02	4.30E-02	3.24E-01	1.60E-01	1.72E+00
		2.07E+05	2.98E-04	2.63E-04	2.28E-05	4.87E-04	6.13E-05
		7.75E+05	1.39E-04	2.38E-04	9.92E-13	9.92E-13	5.95E-05
		1.89E-05	1.19E-05	9.92E-13	4.94E-06	2.43E-06	9.92E-13
		1.29E-04	1.08E-09				
		1.27E+04	3.32E+02	3.41E-02	3.22E-01	1.61E-01	1.71E+00
		2.08E+05	2.99E-04	2.64E-04	2.29E-05	4.90E-04	6.16E-05
		7.79E+05	1.40E-04	2.39E-04	9.97E-13	9.97E-13	5.98E-05
		1.89E-05	1.20E-05	9.97E-13	4.96E-06	2.44E-06	9.97E-13
		1.30E-04	1.08E-09				
		8.21E+03	3.31E+02	3.04E-02	3.11E-01	1.61E-01	1.71E+00
		2.09E+05	3.00E-04	2.65E-04	2.30E-05	4.92E-04	6.18E-05
		7.82E+05	1.40E-04	2.40E-04	1.00E-12	1.00E-12	6.00E-05
		1.90E-05	1.20E-05	1.00E-12	4.98E-06	2.45E-06	1.00E-12
		1.30E-04	1.09E-09				
5	1.50	1.61E+04	3.34E+02	4.42E-02	3.24E-01	1.59E-01	1.72E+00
		2.08E+05	2.98E-04	2.53E-04	2.29E-05	4.78E-04	6.38E-05
		7.76E+05	1.39E-04	2.38E-04	9.93E-13	9.93E-13	5.95E-05
		1.89E-05	1.19E-05	9.93E-13	4.78E-06	2.84E-06	9.93E-13
		1.29E-04	1.25E-09				
		1.15E+04	3.32E+02	3.50E-02	3.22E-01	1.59E-01	1.71E+00
		2.09E+05	2.99E-04	2.54E-04	2.30E-05	4.80E-04	6.41E-05
		7.80E+05	1.40E-04	2.40E-04	9.98E-13	9.98E-13	5.98E-05
		1.90E-05	1.20E-05	9.98E-13	4.80E-06	2.86E-06	9.98E-13
		1.30E-04	1.26E-09				
		7.68E+03	3.31E+02	3.16E-02	3.11E-01	1.60E-01	1.71E+00
		2.09E+05	3.01E-04	2.55E-04	2.30E-05	4.82E-04	6.44E-05
		7.83E+05	1.40E-04	2.40E-04	1.00E-12	1.00E-12	6.00E-05
		1.90E-05	1.20E-05	1.00E-12	4.82E-06	2.87E-06	1.00E-12
		1.30E-04	1.26E-09				
6	1.73	1.51E+04	3.35E+02	4.53E-02	3.25E-01	1.57E-01	1.72E+00
		2.08E+05	2.98E-04	2.44E-04	2.29E-05	4.70E-04	6.62E-05
		7.77E+05	1.39E-04	2.39E-04	9.95E-13	9.95E-13	5.96E-05
		1.89E-05	1.19E-05	9.95E-13	4.64E-06	3.26E-06	9.95E-13
		1.29E-04	1.43E-09				
		1.06E+04	3.33E+02	3.59E-02	3.23E-01	1.58E-01	1.71E+00
		2.09E+05	3.00E-04	2.45E-04	2.30E-05	4.72E-04	6.65E-05
		7.80E+05	1.40E-04	2.40E-04	9.99E-13	9.99E-13	5.99E-05
		1.90E-05	1.20E-05	9.99E-13	4.66E-06	3.28E-06	9.99E-13
		1.30E-04	1.43E-09				
		7.24E+03	3.32E+02	3.26E-02	3.11E-01	1.59E-01	1.71E+00
		2.10E+05	3.01E-04	2.46E-04	2.31E-05	4.74E-04	6.67E-05
		7.83E+05	1.40E-04	2.41E-04	1.00E-12	1.00E-12	6.01E-05
		1.90E-05	1.20E-05	1.00E-12	4.67E-06	3.29E-06	1.00E-12
		1.30E-04	1.44E-09				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data    ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                  H2O        CO2        O3         N2O        CO         CH4
                  O2         NO         SO2        NO2        NH3        HNO3
                  N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                  C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                  CCl4       N2O5

  7   2.00       1.40E+04   3.35E+02   4.65E-02   3.25E-01   1.56E-01   1.73E+00
                 2.08E+05   2.99E-04   2.35E-04   2.29E-05   4.61E-04   6.90E-05
                 7.78E+05   1.39E-04   2.39E-04   9.96E-13   9.96E-13   5.96E-05
                 1.89E-05   1.19E-05   9.96E-13   4.49E-06   3.82E-06   9.96E-13
                 1.29E-04   1.66E-09
                 9.68E+03   3.33E+02   3.69E-02   3.23E-01   1.57E-01   1.72E+00
                 2.09E+05   3.00E-04   2.36E-04   2.30E-05   4.63E-04   6.93E-05
                 7.81E+05   1.40E-04   2.40E-04   1.00E-12   1.00E-12   5.99E-05
                 1.90E-05   1.20E-05   1.00E-12   4.50E-06   3.84E-06   1.00E-12
                 1.30E-04   1.67E-09
                 6.77E+03   3.32E+02   3.39E-02   3.12E-01   1.57E-01   1.71E+00
                 2.10E+05   3.01E-04   2.37E-04   2.31E-05   4.64E-04   6.95E-05
                 7.83E+05   1.40E-04   2.41E-04   1.00E-12   1.00E-12   6.01E-05
                 1.91E-05   1.20E-05   1.00E-12   4.52E-06   3.85E-06   1.00E-12
                 1.30E-04   1.67E-09

------------------------------- Boundary Layer -------------------------------
  8   2.48       1.03E+04   3.36E+02   4.90E-02   3.26E-01   1.54E-01   1.73E+00
                 2.09E+05   3.00E-04   2.12E-04   2.30E-05   4.20E-04   7.38E-05
                 7.81E+05   1.40E-04   2.40E-04   9.99E-13   9.99E-13   5.98E-05
                 1.90E-05   1.20E-05   9.99E-13   4.19E-06   4.58E-06   9.99E-13
                 1.30E-04   1.98E-09
                 7.68E+03   3.34E+02   3.95E-02   3.24E-01   1.54E-01   1.72E+00
                 2.09E+05   3.01E-04   2.13E-04   2.30E-05   4.22E-04   7.40E-05
                 7.83E+05   1.40E-04   2.40E-04   1.00E-12   1.00E-12   6.00E-05
                 1.90E-05   1.20E-05   1.00E-12   4.20E-06   4.59E-06   1.00E-12
                 1.30E-04   1.98E-09
                 5.76E+03   3.32E+02   3.63E-02   3.12E-01   1.55E-01   1.71E+00
                 2.10E+05   3.01E-04   2.13E-04   2.31E-05   4.22E-04   7.42E-05
                 7.84E+05   1.41E-04   2.41E-04   1.00E-12   1.00E-12   6.01E-05
                 1.91E-05   1.20E-05   1.00E-12   4.21E-06   4.60E-06   1.00E-12
                 1.31E-04   1.99E-09

  9   2.80       8.36E+03   3.37E+02   5.06E-02   3.27E-01   1.53E-01   1.74E+00
                 2.09E+05   3.00E-04   1.99E-04   2.30E-05   3.96E-04   7.71E-05
                 7.82E+05   1.40E-04   2.40E-04   1.00E-12   1.00E-12   5.99E-05
                 1.90E-05   1.20E-05   1.00E-12   4.01E-06   5.15E-06   1.00E-12
                 1.30E-04   2.22E-09
                 6.61E+03   3.34E+02   4.12E-02   3.24E-01   1.53E-01   1.72E+00
                 2.10E+05   3.01E-04   1.99E-04   2.31E-05   3.97E-04   7.73E-05
                 7.83E+05   1.40E-04   2.41E-04   1.00E-12   1.00E-12   6.00E-05
                 1.91E-05   1.20E-05   1.00E-12   4.01E-06   5.16E-06   1.00E-12
                 1.30E-04   2.22E-09
                 5.18E+03   3.32E+02   3.80E-02   3.12E-01   1.53E-01   1.71E+00
                 2.10E+05   3.01E-04   1.99E-04   2.31E-05   3.97E-04   7.74E-05
                 7.85E+05   1.41E-04   2.41E-04   1.00E-12   1.00E-12   6.01E-05
                 1.91E-05   1.21E-05   1.00E-12   4.02E-06   5.17E-06   1.00E-12
                 1.31E-04   2.22E-09
```

10	2.87	7.97E+03	3.37E+02	5.10E-02	3.27E-01	1.52E-01	1.74E+00
		2.09E+05	3.01E-04	1.96E-04	2.30E-05	3.90E-04	7.79E-05
		7.82E+05	1.40E-04	2.40E-04	1.00E-12	1.00E-12	6.00E-05
		1.90E-05	1.20E-05	1.00E-12	3.96E-06	5.29E-06	1.00E-12
		1.30E-04	2.28E-09				
		6.38E+03	3.34E+02	4.16E-02	3.24E-01	1.52E-01	1.72E+00
		2.10E+05	3.01E-04	1.96E-04	2.31E-05	3.91E-04	7.80E-05
		7.84E+05	1.40E-04	2.41E-04	1.00E-12	1.00E-12	6.01E-05
		1.91E-05	1.20E-05	1.00E-12	3.97E-06	5.30E-06	1.00E-12
		1.30E-04	2.28E-09				
		5.06E+03	3.32E+02	3.84E-02	3.12E-01	1.53E-01	1.71E+00
		2.10E+05	3.01E-04	1.96E-04	2.31E-05	3.92E-04	7.81E-05
		7.85E+05	1.41E-04	2.41E-04	1.00E-12	1.00E-12	6.01E-05
		1.91E-05	1.21E-05	1.00E-12	3.98E-06	5.31E-06	1.00E-12
		1.31E-04	2.28E-09				
11	3.00	7.34E+03	3.37E+02	5.17E-02	3.27E-01	1.52E-01	1.74E+00
		2.09E+05	3.01E-04	1.90E-04	2.31E-05	3.81E-04	7.93E-05
		7.83E+05	1.40E-04	2.41E-04	1.00E-12	1.00E-12	6.00E-05
		1.90E-05	1.20E-05	1.00E-12	3.89E-06	5.55E-06	1.00E-12
		1.30E-04	2.38E-09				
		6.01E+03	3.34E+02	4.24E-02	3.24E-01	1.52E-01	1.72E+00
		2.10E+05	3.01E-04	1.91E-04	2.31E-05	3.81E-04	7.94E-05
		7.84E+05	1.41E-04	2.41E-04	1.00E-12	1.00E-12	6.01E-05
		1.91E-05	1.20E-05	1.00E-12	3.90E-06	5.56E-06	1.00E-12
		1.30E-04	2.39E-09				
		4.84E+03	3.32E+02	3.91E-02	3.12E-01	1.52E-01	1.71E+00
		2.10E+05	3.01E-04	1.91E-04	2.31E-05	3.82E-04	7.95E-05
		7.85E+05	1.41E-04	2.41E-04	1.00E-12	1.00E-12	6.01E-05
		1.91E-05	1.21E-05	1.00E-12	3.90E-06	5.57E-06	1.00E-12
		1.31E-04	2.39E-09				
12	3.24	6.51E+03	3.38E+02	5.29E-02	3.27E-01	1.51E-01	1.74E+00
		2.10E+05	3.01E-04	1.79E-04	2.31E-05	3.57E-04	8.15E-05
		7.83E+05	1.40E-04	2.41E-04	1.00E-12	1.00E-12	6.00E-05
		1.91E-05	1.20E-05	1.00E-12	3.74E-06	5.92E-06	1.00E-12
		1.30E-04	2.54E-09				
		5.41E+03	3.34E+02	4.37E-02	3.24E-01	1.51E-01	1.72E+00
		2.10E+05	3.01E-04	1.79E-04	2.31E-05	3.58E-04	8.16E-05
		7.84E+05	1.41E-04	2.41E-04	1.00E-12	1.00E-12	6.01E-05
		1.91E-05	1.21E-05	1.00E-12	3.74E-06	5.92E-06	1.00E-12
		1.31E-04	2.54E-09				
		4.46E+03	3.32E+02	4.04E-02	3.12E-01	1.51E-01	1.71E+00
		2.10E+05	3.02E-04	1.80E-04	2.31E-05	3.58E-04	8.17E-05
		7.85E+05	1.41E-04	2.41E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	3.75E-06	5.93E-06	1.01E-12
		1.31E-04	2.54E-09				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************     Molecular Concentrations Profile Data     ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                  H2O        CO2        O3         N2O        CO         CH4
                  O2         NO         SO2        NO2        NH3        HNO3
                  N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                  C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                  CCl4       N2O5

  13   3.60      5.41E+03   3.38E+02   5.50E-02   3.28E-01   1.49E-01   1.74E+00
                 2.10E+05   3.01E-04   1.63E-04   2.31E-05   3.23E-04   8.51E-05
                 7.84E+05   1.41E-04   2.41E-04   1.00E-12   1.00E-12   6.01E-05
                 1.91E-05   1.21E-05   1.00E-12   3.51E-06   6.53E-06   1.00E-12
                 1.31E-04   2.79E-09
                 4.59E+03   3.35E+02   4.59E-02   3.25E-01   1.50E-01   1.72E+00
                 2.10E+05   3.02E-04   1.63E-04   2.31E-05   3.24E-04   8.51E-05
                 7.85E+05   1.41E-04   2.41E-04   1.01E-12   1.01E-12   6.01E-05
                 1.91E-05   1.21E-05   1.01E-12   3.51E-06   6.54E-06   1.01E-12
                 1.31E-04   2.80E-09
                 3.92E+03   3.33E+02   4.26E-02   3.11E-01   1.50E-01   1.71E+00
                 2.10E+05   3.02E-04   1.63E-04   2.31E-05   3.24E-04   8.52E-05
                 7.86E+05   1.41E-04   2.41E-04   1.01E-12   1.01E-12   6.02E-05
                 1.91E-05   1.21E-05   1.01E-12   3.52E-06   6.54E-06   1.01E-12
                 1.31E-04   2.80E-09

  14   3.74      5.05E+03   3.38E+02   5.57E-02   3.28E-01   1.49E-01   1.74E+00
                 2.10E+05   3.01E-04   1.57E-04   2.31E-05   3.11E-04   8.65E-05
                 7.85E+05   1.41E-04   2.41E-04   1.00E-12   1.00E-12   6.01E-05
                 1.91E-05   1.21E-05   1.00E-12   3.43E-06   6.78E-06   1.00E-12
                 1.31E-04   2.90E-09
                 4.32E+03   3.35E+02   4.68E-02   3.25E-01   1.49E-01   1.72E+00
                 2.10E+05   3.02E-04   1.57E-04   2.31E-05   3.12E-04   8.65E-05
                 7.85E+05   1.41E-04   2.41E-04   1.01E-12   1.01E-12   6.01E-05
                 1.91E-05   1.21E-05   1.01E-12   3.43E-06   6.78E-06   1.01E-12
                 1.31E-04   2.90E-09
                 3.74E+03   3.33E+02   4.34E-02   3.11E-01   1.49E-01   1.71E+00
                 2.10E+05   3.02E-04   1.57E-04   2.31E-05   3.12E-04   8.66E-05
                 7.86E+05   1.41E-04   2.41E-04   1.01E-12   1.01E-12   6.02E-05
                 1.91E-05   1.21E-05   1.01E-12   3.43E-06   6.78E-06   1.01E-12
                 1.31E-04   2.90E-09

  15   3.74      5.02E+03   3.38E+02   5.58E-02   3.28E-01   1.49E-01   1.74E+00
                 2.10E+05   3.01E-04   1.57E-04   2.31E-05   3.11E-04   8.65E-05
                 7.85E+05   1.41E-04   2.41E-04   1.00E-12   1.00E-12   6.01E-05
                 1.91E-05   1.21E-05   1.00E-12   3.42E-06   6.79E-06   1.00E-12
                 1.31E-04   2.90E-09
                 4.30E+03   3.35E+02   4.69E-02   3.25E-01   1.49E-01   1.72E+00
                 2.10E+05   3.02E-04   1.57E-04   2.31E-05   3.11E-04   8.66E-05
                 7.85E+05   1.41E-04   2.41E-04   1.01E-12   1.01E-12   6.01E-05
                 1.91E-05   1.21E-05   1.01E-12   3.43E-06   6.80E-06   1.01E-12
                 1.31E-04   2.91E-09
                 3.72E+03   3.33E+02   4.35E-02   3.11E-01   1.49E-01   1.71E+00
                 2.10E+05   3.02E-04   1.57E-04   2.31E-05   3.11E-04   8.67E-05
                 7.86E+05   1.41E-04   2.41E-04   1.01E-12   1.01E-12   6.02E-05
                 1.91E-05   1.21E-05   1.01E-12   3.43E-06   6.80E-06   1.01E-12
                 1.31E-04   2.91E-09
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16	4.00	4.41E+03	3.38E+02	5.73E-02	3.28E-01	1.48E-01	1.74E+00
		2.10E+05	3.02E-04	1.47E-04	2.31E-05	2.90E-04	8.92E-05
		7.85E+05	1.41E-04	2.41E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	3.28E-06	7.28E-06	1.01E-12
		1.31E-04	3.11E-09				
		3.84E+03	3.35E+02	4.85E-02	3.25E-01	1.48E-01	1.72E+00
		2.10E+05	3.02E-04	1.47E-04	2.31E-05	2.90E-04	8.92E-05
		7.86E+05	1.41E-04	2.41E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	3.28E-06	7.28E-06	1.01E-12
		1.31E-04	3.11E-09				
		3.40E+03	3.33E+02	4.51E-02	3.11E-01	1.48E-01	1.71E+00
		2.10E+05	3.02E-04	1.47E-04	2.31E-05	2.90E-04	8.93E-05
		7.86E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	3.28E-06	7.29E-06	1.01E-12
		1.31E-04	3.11E-09				
17	4.10	4.28E+03	3.38E+02	5.79E-02	3.28E-01	1.48E-01	1.74E+00
		2.10E+05	3.02E-04	1.44E-04	2.31E-05	2.80E-04	9.00E-05
		7.85E+05	1.41E-04	2.41E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	3.22E-06	7.97E-06	1.01E-12
		1.31E-04	3.15E-09				
		3.64E+03	3.35E+02	4.91E-02	3.25E-01	1.48E-01	1.72E+00
		2.10E+05	3.02E-04	1.44E-04	2.31E-05	2.80E-04	9.01E-05
		7.86E+05	1.41E-04	2.41E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	3.23E-06	7.98E-06	1.01E-12
		1.31E-04	3.16E-09				
		3.26E+03	3.33E+02	4.58E-02	3.10E-01	1.48E-01	1.71E+00
		2.10E+05	3.02E-04	1.44E-04	2.31E-05	2.80E-04	9.01E-05
		7.86E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	3.23E-06	7.98E-06	1.01E-12
		1.31E-04	3.16E-09				
18	4.24	4.08E+03	3.38E+02	5.88E-02	3.28E-01	1.48E-01	1.74E+00
		2.10E+05	3.02E-04	1.39E-04	2.31E-05	2.66E-04	9.13E-05
		7.85E+05	1.41E-04	2.41E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	3.15E-06	9.12E-06	1.01E-12
		1.31E-04	3.23E-09				
		3.36E+03	3.35E+02	5.01E-02	3.25E-01	1.48E-01	1.72E+00
		2.10E+05	3.02E-04	1.39E-04	2.31E-05	2.66E-04	9.14E-05
		7.86E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	3.15E-06	9.12E-06	1.01E-12
		1.31E-04	3.23E-09				
		3.07E+03	3.33E+02	4.70E-02	3.09E-01	1.48E-01	1.71E+00
		2.10E+05	3.02E-04	1.40E-04	2.32E-05	2.66E-04	9.14E-05
		7.86E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	3.15E-06	9.13E-06	1.01E-12
		1.31E-04	3.23E-09				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************     Molecular Concentrations Profile Data     ****************

Layer Altitude   ------------ Molecular Concentrations (ppmv) -------------
                   H2O        CO2        O3         N2O        CO         CH4
                   O2         NO         SO2        NO2        NH3        HNO3
                   N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                   C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                   CCl4       N2O5

  19   5.00       3.22E+03   3.39E+02   6.36E-02   3.29E-01   1.47E-01   1.74E+00
                  2.10E+05   3.02E-04   1.19E-04   2.31E-05   2.05E-04   9.81E-05
                  7.86E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                  1.91E-05   1.21E-05   1.01E-12   2.77E-06   1.83E-05   1.01E-12
                  1.31E-04   3.63E-09
                  2.24E+03   3.36E+02   5.55E-02   3.25E-01   1.47E-01   1.72E+00
                  2.11E+05   3.02E-04   1.19E-04   2.32E-05   2.06E-04   9.82E-05
                  7.87E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                  1.91E-05   1.21E-05   1.01E-12   2.78E-06   1.83E-05   1.01E-12
                  1.31E-04   3.64E-09
                  2.23E+03   3.33E+02   5.37E-02   3.05E-01   1.47E-01   1.70E+00
                  2.11E+05   3.02E-04   1.19E-04   2.32E-05   2.06E-04   9.82E-05
                  7.87E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                  1.91E-05   1.21E-05   1.01E-12   2.78E-06   1.83E-05   1.01E-12
                  1.31E-04   3.64E-09

  20   5.25       2.96E+03   3.39E+02   6.53E-02   3.29E-01   1.47E-01   1.74E+00
                  2.10E+05   3.02E-04   1.13E-04   2.32E-05   1.89E-04   1.01E-04
                  7.86E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                  1.91E-05   1.21E-05   1.01E-12   2.64E-06   2.06E-05   1.01E-12
                  1.31E-04   3.76E-09
                  2.04E+03   3.36E+02   5.77E-02   3.25E-01   1.47E-01   1.71E+00
                  2.11E+05   3.02E-04   1.13E-04   2.32E-05   1.89E-04   1.01E-04
                  7.87E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                  1.91E-05   1.21E-05   1.01E-12   2.64E-06   2.06E-05   1.01E-12
                  1.31E-04   3.76E-09
                  1.97E+03   3.33E+02   5.66E-02   3.02E-01   1.47E-01   1.70E+00
                  2.11E+05   3.02E-04   1.13E-04   2.32E-05   1.89E-04   1.01E-04
                  7.87E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                  1.91E-05   1.21E-05   1.01E-12   2.64E-06   2.06E-05   1.01E-12
                  1.31E-04   3.76E-09

  21   6.00       2.28E+03   3.39E+02   7.07E-02   3.29E-01   1.45E-01   1.73E+00
                  2.11E+05   3.02E-04   9.78E-05   2.32E-05   1.47E-04   1.12E-04
                  7.87E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                  1.91E-05   1.21E-05   1.01E-12   2.27E-06   2.93E-05   1.01E-12
                  1.30E-04   4.16E-09
                  1.52E+03   3.36E+02   6.46E-02   3.26E-01   1.46E-01   1.70E+00
                  2.11E+05   3.02E-04   9.79E-05   2.32E-05   1.47E-04   1.12E-04
                  7.87E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                  1.92E-05   1.21E-05   1.01E-12   2.27E-06   2.93E-05   1.01E-12
                  1.31E-04   4.16E-09
                  1.34E+03   3.34E+02   6.62E-02   2.94E-01   1.46E-01   1.69E+00
                  2.11E+05   3.03E-04   9.79E-05   2.32E-05   1.47E-04   1.12E-04
                  7.88E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.03E-05
                  1.92E-05   1.21E-05   1.01E-12   2.27E-06   2.93E-05   1.01E-12
                  1.31E-04   4.16E-09
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22	6.29	1.99E+03	3.39E+02	7.15E-02	3.29E-01	1.44E-01	1.73E+00
		2.11E+05	3.02E-04	9.35E-05	2.32E-05	1.31E-04	1.16E-04
		7.87E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	2.11E-06	3.21E-05	1.01E-12
		1.30E-04	4.30E-09				
		1.36E+03	3.36E+02	6.83E-02	3.26E-01	1.44E-01	1.69E+00
		2.11E+05	3.03E-04	9.36E-05	2.32E-05	1.31E-04	1.16E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	2.11E-06	3.21E-05	1.01E-12
		1.31E-04	4.30E-09				
		1.16E+03	3.34E+02	6.94E-02	2.91E-01	1.44E-01	1.68E+00
		2.11E+05	3.03E-04	9.36E-05	2.32E-05	1.32E-04	1.16E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.03E-05
		1.92E-05	1.21E-05	1.01E-12	2.11E-06	3.22E-05	1.01E-12
		1.31E-04	4.31E-09				
23	6.32	1.96E+03	3.39E+02	7.15E-02	3.29E-01	1.44E-01	1.73E+00
		2.11E+05	3.02E-04	9.30E-05	2.32E-05	1.30E-04	1.17E-04
		7.87E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	2.09E-06	3.25E-05	1.01E-12
		1.30E-04	4.32E-09				
		1.34E+03	3.36E+02	6.88E-02	3.26E-01	1.44E-01	1.69E+00
		2.11E+05	3.03E-04	9.31E-05	2.32E-05	1.30E-04	1.17E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	2.09E-06	3.25E-05	1.01E-12
		1.31E-04	4.32E-09				
		1.14E+03	3.34E+02	6.98E-02	2.91E-01	1.44E-01	1.68E+00
		2.11E+05	3.03E-04	9.31E-05	2.32E-05	1.30E-04	1.17E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.03E-05
		1.92E-05	1.21E-05	1.01E-12	2.09E-06	3.25E-05	1.01E-12
		1.31E-04	4.32E-09				
24	6.40	1.89E+03	3.39E+02	7.17E-02	3.29E-01	1.44E-01	1.73E+00
		2.11E+05	3.02E-04	9.19E-05	2.32E-05	1.26E-04	1.18E-04
		7.87E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.91E-05	1.21E-05	1.01E-12	2.05E-06	3.33E-05	1.01E-12
		1.30E-04	4.36E-09				
		1.30E+03	3.36E+02	6.98E-02	3.26E-01	1.44E-01	1.69E+00
		2.11E+05	3.03E-04	9.20E-05	2.32E-05	1.26E-04	1.18E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	2.05E-06	3.33E-05	1.01E-12
		1.31E-04	4.36E-09				
		1.09E+03	3.34E+02	7.07E-02	2.90E-01	1.44E-01	1.68E+00
		2.11E+05	3.03E-04	9.20E-05	2.32E-05	1.26E-04	1.18E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.03E-05
		1.92E-05	1.21E-05	1.01E-12	2.05E-06	3.33E-05	1.01E-12
		1.31E-04	4.36E-09				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data    ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                  H2O        CO2        O3         N2O        CO         CH4
                  O2         NO         SO2        NO2        NH3        HNO3
                  N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                  C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                  CCl4       N2O5

 25   6.90       1.49E+03   3.39E+02   7.30E-02   3.29E-01   1.41E-01   1.72E+00
                 2.11E+05   3.02E-04   8.50E-05   2.32E-05   1.04E-04   1.25E-04
                 7.87E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                 1.92E-05   1.21E-05   1.01E-12   1.80E-06   3.91E-05   1.01E-12
                 1.30E-04   4.63E-09
                 1.07E+03   3.36E+02   7.68E-02   3.26E-01   1.41E-01   1.68E+00
                 2.11E+05   3.03E-04   8.50E-05   2.32E-05   1.04E-04   1.26E-04
                 7.88E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.03E-05
                 1.92E-05   1.21E-05   1.01E-12   1.81E-06   3.91E-05   1.01E-12
                 1.30E-04   4.63E-09
                 8.46E+02   3.34E+02   7.68E-02   2.86E-01   1.42E-01   1.67E+00
                 2.11E+05   3.03E-04   8.51E-05   2.32E-05   1.04E-04   1.26E-04
                 7.88E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.03E-05
                 1.92E-05   1.21E-05   1.01E-12   1.81E-06   3.91E-05   1.01E-12
                 1.30E-04   4.63E-09

 26   7.00       1.42E+03   3.39E+02   7.32E-02   3.29E-01   1.41E-01   1.72E+00
                 2.11E+05   3.02E-04   8.37E-05   2.32E-05   9.96E-05   1.27E-04
                 7.87E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                 1.92E-05   1.21E-05   1.01E-12   1.76E-06   4.03E-05   1.01E-12
                 1.30E-04   4.68E-09
                 1.03E+03   3.36E+02   7.83E-02   3.26E-01   1.41E-01   1.68E+00
                 2.11E+05   3.03E-04   8.37E-05   2.32E-05   9.97E-05   1.27E-04
                 7.88E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.03E-05
                 1.92E-05   1.21E-05   1.01E-12   1.76E-06   4.03E-05   1.01E-12
                 1.30E-04   4.68E-09
                 8.04E+02   3.34E+02   7.81E-02   2.85E-01   1.41E-01   1.67E+00
                 2.11E+05   3.03E-04   8.37E-05   2.32E-05   9.97E-05   1.27E-04
                 7.88E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.03E-05
                 1.92E-05   1.21E-05   1.01E-12   1.76E-06   4.03E-05   1.01E-12
                 1.30E-04   4.68E-09

 27   8.00       8.53E+02   3.40E+02   7.79E-02   3.29E-01   1.34E-01   1.71E+00
                 2.11E+05   3.03E-04   7.27E-05   2.32E-05   6.54E-05   1.40E-04
                 7.88E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                 1.92E-05   1.21E-05   1.01E-12   1.25E-06   5.14E-05   1.01E-12
                 1.30E-04   5.21E-09
                 6.52E+02   3.36E+02   9.21E-02   3.25E-01   1.34E-01   1.66E+00
                 2.11E+05   3.03E-04   7.28E-05   2.32E-05   6.54E-05   1.40E-04
                 7.88E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.02E-05
                 1.92E-05   1.21E-05   1.01E-12   1.25E-06   5.14E-05   1.01E-12
                 1.30E-04   5.21E-09
                 4.03E+02   3.34E+02   9.20E-02   2.79E-01   1.34E-01   1.65E+00
                 2.11E+05   3.03E-04   7.28E-05   2.32E-05   6.54E-05   1.40E-04
                 7.88E+05   1.41E-04   2.42E-04   1.01E-12   1.01E-12   6.03E-05
                 1.92E-05   1.21E-05   1.01E-12   1.25E-06   5.14E-05   1.01E-12
                 1.30E-04   5.21E-09
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28	8.33	7.08E+02	3.40E+02	7.95E-02	3.28E-01	1.31E-01	1.71E+00
		2.11E+05	3.03E-04	7.05E-05	2.33E-05	5.46E-05	1.45E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.24E-06	5.07E-05	1.01E-12
		1.30E-04	5.40E-09				
		5.62E+02	3.36E+02	9.84E-02	3.24E-01	1.31E-01	1.65E+00
		2.11E+05	3.03E-04	7.05E-05	2.33E-05	5.46E-05	1.45E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.24E-06	5.08E-05	1.01E-12
		1.30E-04	5.40E-09				
		2.77E+02	3.34E+02	1.07E-01	2.77E-01	1.31E-01	1.64E+00
		2.11E+05	3.03E-04	7.05E-05	2.33E-05	5.46E-05	1.45E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.24E-06	5.08E-05	1.01E-12
		1.30E-04	5.40E-09				
29	8.83	5.36E+02	3.40E+02	8.21E-02	3.28E-01	1.25E-01	1.70E+00
		2.11E+05	3.03E-04	6.73E-05	2.34E-05	4.16E-05	1.52E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.22E-06	4.98E-05	1.01E-12
		1.30E-04	5.71E-09				
		4.49E+02	3.36E+02	1.09E-01	3.23E-01	1.25E-01	1.65E+00
		2.11E+05	3.03E-04	6.73E-05	2.34E-05	4.16E-05	1.52E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.22E-06	4.99E-05	1.01E-12
		1.30E-04	5.71E-09				
		1.58E+02	3.34E+02	1.33E-01	2.74E-01	1.25E-01	1.64E+00
		2.11E+05	3.03E-04	6.73E-05	2.34E-05	4.16E-05	1.52E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.22E-06	4.99E-05	1.01E-12
		1.30E-04	5.71E-09				
30	8.91	5.13E+02	3.40E+02	8.25E-02	3.27E-01	1.25E-01	1.70E+00
		2.11E+05	3.03E-04	6.68E-05	2.34E-05	3.99E-05	1.53E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.22E-06	4.97E-05	1.01E-12
		1.30E-04	5.76E-09				
		4.34E+02	3.36E+02	1.10E-01	3.22E-01	1.25E-01	1.65E+00
		2.11E+05	3.03E-04	6.68E-05	2.34E-05	3.99E-05	1.53E-04
		7.88E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.22E-06	4.97E-05	1.01E-12
		1.30E-04	5.76E-09				
		1.45E+02	3.34E+02	1.38E-01	2.74E-01	1.25E-01	1.64E+00
		2.11E+05	3.03E-04	6.68E-05	2.34E-05	3.99E-05	1.53E-04
		7.89E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.02E-05
		1.92E-05	1.21E-05	1.01E-12	1.22E-06	4.97E-05	1.01E-12
		1.30E-04	5.76E-09				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data      ****************

Layer Altitude   ------------ Molecular Concentrations (ppmv) -------------
                  H2O         CO2         O3          N2O         CO          CH4
                  O2          NO          SO2         NO2         NH3         HNO3
                  N2          CCl3F       CCl2F2      CClF3       CF4         CHF2Cl
                  C2CL3F3     C2Cl2F4     C2ClF5      ClONO2      HNO4        CHCl2F
                  CCl4        N2O5

  31   9.00       4.88E+02    3.40E+02    8.30E-02    3.27E-01    1.24E-01    1.70E+00
                  2.11E+05    3.03E-04    6.62E-05    2.34E-05    3.80E-05    1.54E-04
                  7.88E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.92E-05    1.21E-05    1.01E-12    1.22E-06    4.96E-05    1.01E-12
                  1.30E-04    5.82E-09
                  4.17E+02    3.36E+02    1.12E-01    3.22E-01    1.24E-01    1.64E+00
                  2.11E+05    3.03E-04    6.62E-05    2.34E-05    3.81E-05    1.54E-04
                  7.88E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.92E-05    1.21E-05    1.01E-12    1.22E-06    4.96E-05    1.01E-12
                  1.30E-04    5.82E-09
                  1.31E+02    3.34E+02    1.43E-01    2.74E-01    1.24E-01    1.63E+00
                  2.11E+05    3.03E-04    6.62E-05    2.34E-05    3.81E-05    1.54E-04
                  7.89E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.92E-05    1.21E-05    1.01E-12    1.22E-06    4.96E-05    1.01E-12
                  1.30E-04    5.82E-09

  32   9.41       3.73E+02    3.40E+02    8.52E-02    3.26E-01    1.19E-01    1.69E+00
                  2.11E+05    3.03E-04    6.42E-05    2.37E-05    2.95E-05    1.63E-04
                  7.88E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.91E-05    1.21E-05    1.01E-12    1.21E-06    4.88E-05    1.01E-12
                  1.30E-04    6.06E-09
                  3.38E+02    3.36E+02    1.20E-01    3.19E-01    1.19E-01    1.63E+00
                  2.11E+05    3.03E-04    6.42E-05    2.37E-05    2.95E-05    1.63E-04
                  7.88E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.91E-05    1.21E-05    1.01E-12    1.21E-06    4.88E-05    1.01E-12
                  1.30E-04    6.06E-09
                  8.28E+01    3.34E+02    1.61E-01    2.71E-01    1.19E-01    1.62E+00
                  2.11E+05    3.03E-04    6.42E-05    2.37E-05    2.95E-05    1.63E-04
                  7.89E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.92E-05    1.21E-05    1.01E-12    1.21E-06    4.88E-05    1.01E-12
                  1.30E-04    6.06E-09

------------------------------ Tropopause No. 3/1 ----------------------------
  33   10.0       2.53E+02    3.40E+02    8.85E-02    3.23E-01    1.13E-01    1.68E+00
                  2.11E+05    3.03E-04    6.14E-05    2.40E-05    2.05E-05    1.76E-04
                  7.88E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.91E-05    1.21E-05    1.01E-12    1.19E-06    4.77E-05    1.01E-12
                  1.30E-04    6.43E-09
                  2.50E+02    3.36E+02    1.32E-01    3.15E-01    1.13E-01    1.61E+00
                  2.11E+05    3.03E-04    6.14E-05    2.40E-05    2.05E-05    1.76E-04
                  7.88E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.91E-05    1.21E-05    1.01E-12    1.19E-06    4.77E-05    1.01E-12
                  1.30E-04    6.43E-09
                  4.28E+01    3.34E+02    1.91E-01    2.68E-01    1.13E-01    1.60E+00
                  2.11E+05    3.03E-04    6.14E-05    2.40E-05    2.05E-05    1.76E-04
                  7.89E+05    1.41E-04    2.42E-04    1.01E-12    1.01E-12    6.02E-05
                  1.91E-05    1.21E-05    1.01E-12    1.19E-06    4.78E-05    1.01E-12
                  1.30E-04    6.43E-09
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34	11.0	9.70E+01	3.40E+02	9.76E-02	3.16E-01	1.01E-01	1.66E+00
		2.11E+05	3.03E-04	5.85E-05	2.65E-05	1.10E-05	2.04E-04
		7.89E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	1.15E-06	4.59E-05	1.01E-12
		1.30E-04	7.04E-09				
		9.65E+01	3.36E+02	1.81E-01	3.05E-01	1.01E-01	1.57E+00
		2.11E+05	3.03E-04	5.85E-05	2.65E-05	1.10E-05	2.04E-04
		7.89E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	1.15E-06	4.59E-05	1.01E-12
		1.30E-04	7.04E-09				
		1.34E+01	3.34E+02	3.08E-01	2.63E-01	1.01E-01	1.56E+00
		2.11E+05	3.03E-04	5.85E-05	2.65E-05	1.10E-05	2.04E-04
		7.89E+05	1.41E-04	2.42E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	1.15E-06	4.59E-05	1.01E-12
		1.30E-04	7.04E-09				
35	12.0	3.23E+01	3.40E+02	1.14E-01	3.11E-01	8.85E-02	1.63E+00
		2.11E+05	3.03E-04	5.65E-05	3.18E-05	6.36E-06	2.43E-04
		7.89E+05	1.40E-04	2.41E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	1.12E-06	4.41E-05	1.01E-12
		1.30E-04	7.64E-09				
		2.97E+01	3.36E+02	2.25E-01	2.99E-01	8.85E-02	1.54E+00
		2.11E+05	3.03E-04	5.65E-05	3.18E-05	6.36E-06	2.43E-04
		7.89E+05	1.40E-04	2.41E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	1.12E-06	4.41E-05	1.01E-12
		1.30E-04	7.64E-09				
		6.06E+00	3.34E+02	4.14E-01	2.58E-01	8.85E-02	1.52E+00
		2.11E+05	3.03E-04	5.65E-05	3.18E-05	6.36E-06	2.43E-04
		7.89E+05	1.40E-04	2.41E-04	1.01E-12	1.01E-12	6.01E-05
		1.91E-05	1.21E-05	1.01E-12	1.12E-06	4.41E-05	1.01E-12
		1.30E-04	7.64E-09				

---------------------------- Tropopause No. 2/1 ----------------------------

36	13.0	9.48E+00	3.40E+02	1.41E-01	3.04E-01	7.22E-02	1.61E+00
		2.11E+05	3.02E-04	5.64E-05	4.49E-05	3.15E-06	2.79E-04
		7.89E+05	1.36E-04	2.38E-04	1.01E-12	1.01E-12	5.95E-05
		1.87E-05	1.20E-05	1.01E-12	8.09E-06	5.71E-05	1.01E-12
		1.26E-04	4.45E-07				
		8.08E+00	3.36E+02	3.03E-01	2.91E-01	7.22E-02	1.51E+00
		2.11E+05	3.02E-04	5.64E-05	4.49E-05	3.15E-06	2.79E-04
		7.89E+05	1.36E-04	2.38E-04	1.01E-12	1.01E-12	5.95E-05
		1.87E-05	1.20E-05	1.01E-12	8.09E-06	5.71E-05	1.01E-12
		1.26E-04	4.45E-07				
		4.49E+00	3.34E+02	5.05E-01	2.52E-01	7.22E-02	1.49E+00
		2.11E+05	3.02E-04	5.64E-05	4.49E-05	3.15E-06	2.79E-04
		7.89E+05	1.36E-04	2.38E-04	1.01E-12	1.01E-12	5.95E-05
		1.87E-05	1.20E-05	1.01E-12	8.09E-06	5.71E-05	1.01E-12
		1.26E-04	4.45E-07				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************     Molecular Concentrations Profile Data     ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                  H2O       CO2       O3        N2O       CO        CH4
                  O2        NO        SO2       NO2       NH3       HNO3
                  N2        CCl3F     CCl2F2    CClF3     CF4       CHF2Cl
                  C2CL3F3   C2Cl2F4   C2ClF5    ClONO2    HNO4      CHCl2F
                  CCl4      N2O5

  37  14.0       5.79E+00  3.40E+02  1.74E-01  2.99E-01  5.69E-02  1.58E+00
                 2.11E+05  2.98E-04  5.69E-05  7.55E-05  1.12E-06  3.36E-04
                 7.89E+05  1.32E-04  2.34E-04  1.01E-12  1.01E-12  5.89E-05
                 1.84E-05  1.19E-05  1.01E-12  1.51E-05  7.01E-05  1.01E-12
                 1.22E-04  8.82E-07
                 5.05E+00  3.36E+02  4.44E-01  2.85E-01  5.69E-02  1.48E+00
                 2.11E+05  2.98E-04  5.70E-05  7.55E-05  1.12E-06  3.36E-04
                 7.89E+05  1.32E-04  2.34E-04  1.01E-12  1.01E-12  5.89E-05
                 1.84E-05  1.19E-05  1.01E-12  1.51E-05  7.01E-05  1.01E-12
                 1.22E-04  8.82E-07
                 4.04E+00  3.34E+02  6.06E-01  2.46E-01  5.69E-02  1.45E+00
                 2.11E+05  2.98E-04  5.70E-05  7.55E-05  1.12E-06  3.36E-04
                 7.89E+05  1.32E-04  2.34E-04  1.01E-12  1.01E-12  5.89E-05
                 1.84E-05  1.19E-05  1.01E-12  1.51E-05  7.01E-05  1.01E-12
                 1.22E-04  8.82E-07

----------------------------- Tropopause No. 1/1 ----------------------------
  38  15.0       3.63E+00  3.40E+02  2.20E-01  2.92E-01  4.46E-02  1.56E+00
                 2.11E+05  2.86E-04  5.81E-05  1.73E-04  4.51E-07  4.56E-04
                 7.89E+05  1.28E-04  2.31E-04  1.01E-12  1.01E-12  5.83E-05
                 1.80E-05  1.17E-05  1.01E-12  2.20E-05  8.31E-05  1.01E-12
                 1.18E-04  1.32E-06
                 3.43E+00  3.36E+02  5.05E-01  2.78E-01  4.46E-02  1.45E+00
                 2.11E+05  2.86E-04  5.81E-05  1.73E-04  4.51E-07  4.56E-04
                 7.89E+05  1.28E-04  2.31E-04  1.01E-12  1.01E-12  5.83E-05
                 1.80E-05  1.17E-05  1.01E-12  2.20E-05  8.31E-05  1.01E-12
                 1.18E-04  1.32E-06
                 4.04E+00  3.34E+02  7.07E-01  2.38E-01  4.46E-02  1.41E+00
                 2.11E+05  2.86E-04  5.81E-05  1.73E-04  4.51E-07  4.56E-04
                 7.89E+05  1.28E-04  2.31E-04  1.01E-12  1.01E-12  5.83E-05
                 1.80E-05  1.17E-05  1.01E-12  2.20E-05  8.31E-05  1.01E-12
                 1.18E-04  1.32E-06

  39  16.0       3.33E+00  3.40E+02  3.16E-01  2.83E-01  3.47E-02  1.53E+00
                 2.11E+05  2.71E-04  5.81E-05  3.22E-04  2.13E-07  7.44E-04
                 7.89E+05  1.24E-04  2.27E-04  1.01E-12  1.01E-12  5.78E-05
                 1.77E-05  1.16E-05  1.01E-12  2.90E-05  9.60E-05  1.01E-12
                 1.14E-04  1.76E-06
                 3.33E+00  3.36E+02  6.06E-01  2.66E-01  3.47E-02  1.42E+00
                 2.11E+05  2.71E-04  5.81E-05  3.22E-04  2.13E-07  7.44E-04
                 7.89E+05  1.24E-04  2.27E-04  1.01E-12  1.01E-12  5.78E-05
                 1.77E-05  1.16E-05  1.01E-12  2.90E-05  9.60E-05  1.01E-12
                 1.14E-04  1.76E-06
                 4.04E+00  3.34E+02  8.58E-01  2.31E-01  3.47E-02  1.36E+00
                 2.11E+05  2.71E-04  5.81E-05  3.22E-04  2.13E-07  7.44E-04
                 7.89E+05  1.24E-04  2.27E-04  1.01E-12  1.01E-12  5.78E-05
                 1.77E-05  1.16E-05  1.01E-12  2.90E-05  9.60E-05  1.01E-12
                 1.14E-04  1.76E-06
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40	17.0	3.23E+00	3.40E+02	4.90E-01	2.68E-01	2.82E-02	1.50E+00
		2.11E+05	2.54E-04	5.42E-05	5.24E-04	1.11E-07	1.32E-03
		7.89E+05	1.13E-04	2.17E-04	1.01E-12	1.01E-12	5.62E-05
		1.67E-05	1.13E-05	1.01E-12	1.02E-04	1.44E-04	1.01E-12
		1.03E-04	8.87E-06				
		3.23E+00	3.36E+02	7.07E-01	2.47E-01	2.82E-02	1.38E+00
		2.11E+05	2.54E-04	5.42E-05	5.24E-04	1.11E-07	1.32E-03
		7.89E+05	1.13E-04	2.17E-04	1.01E-12	1.01E-12	5.62E-05
		1.67E-05	1.13E-05	1.01E-12	1.02E-04	1.44E-04	1.01E-12
		1.03E-04	8.87E-06				
		4.09E+00	3.34E+02	1.01E+00	2.21E-01	2.82E-02	1.31E+00
		2.11E+05	2.54E-04	5.42E-05	5.24E-04	1.11E-07	1.32E-03
		7.89E+05	1.13E-04	2.17E-04	1.01E-12	1.01E-12	5.62E-05
		1.67E-05	1.13E-05	1.01E-12	1.02E-04	1.44E-04	1.01E-12
		1.03E-04	8.87E-06				
41	18.0	3.18E+00	3.40E+02	7.62E-01	2.49E-01	2.23E-02	1.46E+00
		2.11E+05	2.42E-04	4.83E-05	7.79E-04	6.77E-08	2.13E-03
		7.89E+05	1.03E-04	2.06E-04	1.01E-12	1.01E-12	5.46E-05
		1.57E-05	1.10E-05	1.01E-12	1.76E-04	1.92E-04	1.01E-12
		9.15E-05	1.60E-05				
		3.18E+00	3.36E+02	1.01E+00	2.22E-01	2.23E-02	1.35E+00
		2.11E+05	2.42E-04	4.83E-05	7.79E-04	6.77E-08	2.13E-03
		7.89E+05	1.03E-04	2.06E-04	1.01E-12	1.01E-12	5.46E-05
		1.57E-05	1.10E-05	1.01E-12	1.76E-04	1.92E-04	1.01E-12
		9.15E-05	1.60E-05				
		4.34E+00	3.34E+02	1.31E+00	2.06E-01	2.23E-02	1.24E+00
		2.11E+05	2.42E-04	4.83E-05	7.79E-04	6.77E-08	2.13E-03
		7.89E+05	1.03E-04	2.06E-04	1.01E-12	1.01E-12	5.46E-05
		1.57E-05	1.10E-05	1.01E-12	1.76E-04	1.92E-04	1.01E-12
		9.15E-05	1.60E-05				
42	19.0	3.23E+00	3.40E+02	1.16E+00	2.25E-01	1.75E-02	1.42E+00
		2.11E+05	2.46E-04	4.01E-05	1.07E-03	4.01E-08	3.20E-03
		7.89E+05	9.18E-05	1.96E-04	1.01E-12	1.01E-12	5.30E-05
		1.47E-05	1.06E-05	1.01E-12	2.50E-04	2.40E-04	1.01E-12
		8.02E-05	2.31E-05				
		3.23E+00	3.36E+02	1.51E+00	1.88E-01	1.75E-02	1.31E+00
		2.11E+05	2.46E-04	4.01E-05	1.07E-03	4.01E-08	3.20E-03
		7.89E+05	9.18E-05	1.96E-04	1.01E-12	1.01E-12	5.30E-05
		1.47E-05	1.06E-05	1.01E-12	2.50E-04	2.40E-04	1.01E-12
		8.02E-05	2.31E-05				
		4.54E+00	3.34E+02	1.72E+00	1.84E-01	1.75E-02	1.17E+00
		2.11E+05	2.46E-04	4.01E-05	1.07E-03	4.01E-08	3.20E-03
		7.89E+05	9.18E-05	1.96E-04	1.01E-12	1.01E-12	5.30E-05
		1.47E-05	1.06E-05	1.01E-12	2.50E-04	2.40E-04	1.01E-12
		8.02E-05	2.31E-05				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************     Molecular Concentrations Profile Data     ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                  H2O        CO2        O3         N2O        CO         CH4
                  O2         NO         SO2        NO2        NH3        HNO3
                  N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                  C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                  CCl4       N2O5

  43   20.0      3.33E+00   3.40E+02   1.58E+00   2.05E-01   1.51E-02   1.36E+00
                 2.11E+05   2.57E-04   3.22E-05   1.40E-03   2.43E-08   4.24E-03
                 7.89E+05   8.10E-05   1.86E-04   1.01E-12   1.01E-12   5.14E-05
                 1.37E-05   1.03E-05   1.01E-12   3.23E-04   2.88E-04   1.01E-12
                 6.89E-05   3.02E-05
                 3.33E+00   3.36E+02   2.02E+00   1.64E-01   1.51E-02   1.25E+00
                 2.11E+05   2.57E-04   3.22E-05   1.40E-03   2.43E-08   4.24E-03
                 7.89E+05   8.10E-05   1.86E-04   1.01E-12   1.01E-12   5.14E-05
                 1.37E-05   1.03E-05   1.01E-12   3.23E-04   2.88E-04   1.01E-12
                 6.89E-05   3.02E-05
                 4.64E+00   3.34E+02   2.12E+00   1.59E-01   1.51E-02   1.08E+00
                 2.11E+05   2.57E-04   3.22E-05   1.40E-03   2.43E-08   4.24E-03
                 7.89E+05   8.10E-05   1.86E-04   1.01E-12   1.01E-12   5.14E-05
                 1.37E-05   1.03E-05   1.01E-12   3.23E-04   2.88E-04   1.01E-12
                 6.89E-05   3.02E-05

  44   21.0      3.48E+00   3.40E+02   2.20E+00   1.81E-01   1.39E-02   1.29E+00
                 2.11E+05   2.80E-04   2.70E-05   1.78E-03   1.94E-08   4.99E-03
                 7.89E+05   6.93E-05   1.73E-04   1.01E-12   1.01E-12   4.94E-05
                 1.25E-05   9.85E-06   1.01E-12   4.64E-04   3.55E-04   1.01E-12
                 5.77E-05   4.19E-05
                 3.48E+00   3.36E+02   2.42E+00   1.35E-01   1.39E-02   1.18E+00
                 2.11E+05   2.80E-04   2.70E-05   1.78E-03   1.94E-08   4.99E-03
                 7.89E+05   6.93E-05   1.73E-04   1.01E-12   1.01E-12   4.94E-05
                 1.25E-05   9.85E-06   1.01E-12   4.64E-04   3.55E-04   1.01E-12
                 5.77E-05   4.19E-05
                 4.75E+00   3.34E+02   2.73E+00   1.37E-01   1.39E-02   1.00E+00
                 2.11E+05   2.80E-04   2.70E-05   1.78E-03   1.94E-08   4.99E-03
                 7.89E+05   6.93E-05   1.73E-04   1.01E-12   1.01E-12   4.94E-05
                 1.25E-05   9.85E-06   1.01E-12   4.64E-04   3.55E-04   1.01E-12
                 5.77E-05   4.19E-05

  45   22.0      3.67E+00   3.40E+02   2.83E+00   1.65E-01   1.39E-02   1.20E+00
                 2.11E+05   3.10E-04   2.30E-05   2.18E-03   1.74E-08   5.51E-03
                 7.89E+05   5.77E-05   1.60E-04   1.01E-12   1.01E-12   4.74E-05
                 1.13E-05   9.40E-06   1.01E-12   6.06E-04   4.23E-04   1.01E-12
                 4.65E-05   5.35E-05
                 3.64E+00   3.36E+02   2.93E+00   1.17E-01   1.39E-02   1.09E+00
                 2.11E+05   3.10E-04   2.30E-05   2.18E-03   1.74E-08   5.51E-03
                 7.89E+05   5.77E-05   1.60E-04   1.01E-12   1.01E-12   4.74E-05
                 1.13E-05   9.40E-06   1.01E-12   6.06E-04   4.23E-04   1.01E-12
                 4.65E-05   5.35E-05
                 4.85E+00   3.34E+02   3.33E+00   1.23E-01   1.39E-02   9.28E-01
                 2.11E+05   3.10E-04   2.30E-05   2.18E-03   1.74E-08   5.51E-03
                 7.89E+05   5.77E-05   1.60E-04   1.01E-12   1.01E-12   4.74E-05
                 1.13E-05   9.40E-06   1.01E-12   6.06E-04   4.23E-04   1.01E-12
                 4.65E-05   5.35E-05
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46	23.0	3.66E+00	3.40E+02	3.51E+00	1.55E-01	1.48E-02	1.11E+00
		2.11E+05	3.64E-04	2.09E-05	2.61E-03	1.61E-08	5.80E-03
		7.89E+05	4.60E-05	1.46E-04	1.01E-12	1.01E-12	4.54E-05
		1.00E-05	8.95E-06	1.01E-12	7.47E-04	4.90E-04	1.01E-12
		3.54E-05	6.52E-05				
		3.89E+00	3.36E+02	3.43E+00	1.05E-01	1.48E-02	9.91E-01
		2.11E+05	3.64E-04	2.09E-05	2.61E-03	1.61E-08	5.80E-03
		7.89E+05	4.60E-05	1.46E-04	1.01E-12	1.01E-12	4.54E-05
		1.00E-05	8.95E-06	1.01E-12	7.47E-04	4.90E-04	1.01E-12
		3.54E-05	6.52E-05				
		4.88E+00	3.34E+02	3.74E+00	1.12E-01	1.48E-02	8.68E-01
		2.11E+05	3.64E-04	2.09E-05	2.61E-03	1.61E-08	5.80E-03
		7.89E+05	4.60E-05	1.46E-04	1.01E-12	1.01E-12	4.54E-05
		1.00E-05	8.95E-06	1.01E-12	7.47E-04	4.90E-04	1.01E-12
		3.54E-05	6.52E-05				
47	24.0	3.80E+00	3.40E+02	4.22E+00	1.46E-01	1.59E-02	1.03E+00
		2.11E+05	4.55E-04	1.92E-05	3.09E-03	1.45E-08	5.90E-03
		7.89E+05	3.43E-05	1.33E-04	1.01E-12	1.01E-12	4.34E-05
		8.79E-06	8.50E-06	1.01E-12	8.89E-04	5.57E-04	1.01E-12
		2.42E-05	7.68E-05				
		4.04E+00	3.36E+02	4.04E+00	9.80E-02	1.59E-02	8.97E-01
		2.11E+05	4.55E-04	1.92E-05	3.09E-03	1.45E-08	5.90E-03
		7.89E+05	3.43E-05	1.33E-04	1.01E-12	1.01E-12	4.34E-05
		8.79E-06	8.50E-06	1.01E-12	8.89E-04	5.57E-04	1.01E-12
		2.42E-05	7.68E-05				
		4.90E+00	3.34E+02	4.24E+00	1.00E-01	1.59E-02	8.11E-01
		2.11E+05	4.55E-04	1.92E-05	3.09E-03	1.45E-08	5.90E-03
		7.89E+05	3.43E-05	1.33E-04	1.01E-12	1.01E-12	4.34E-05
		8.79E-06	8.50E-06	1.01E-12	8.89E-04	5.57E-04	1.01E-12
		2.42E-05	7.68E-05				
48	25.0	3.82E+00	3.40E+02	4.90E+00	1.37E-01	1.72E-02	9.50E-01
		2.11E+05	6.92E-04	1.77E-05	3.78E-03	1.24E-08	5.66E-03
		7.89E+05	2.75E-05	1.20E-04	1.01E-12	1.01E-12	4.12E-05
		7.68E-06	8.03E-06	1.01E-12	9.82E-04	5.86E-04	1.01E-12
		1.90E-05	7.78E-05				
		4.24E+00	3.36E+02	4.85E+00	9.13E-02	1.72E-02	8.04E-01
		2.11E+05	6.92E-04	1.77E-05	3.78E-03	1.24E-08	5.66E-03
		7.89E+05	2.75E-05	1.20E-04	1.01E-12	1.01E-12	4.12E-05
		7.68E-06	8.03E-06	1.01E-12	9.82E-04	5.86E-04	1.01E-12
		1.90E-05	7.78E-05				
		4.95E+00	3.34E+02	4.54E+00	8.88E-02	1.71E-02	7.57E-01
		2.11E+05	6.92E-04	1.77E-05	3.78E-03	1.24E-08	5.66E-03
		7.89E+05	2.75E-05	1.20E-04	1.01E-12	1.01E-12	4.12E-05
		7.68E-06	8.03E-06	1.01E-12	9.82E-04	5.86E-04	1.01E-12
		1.90E-05	7.78E-05				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data    ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                 H2O       CO2       O3        N2O       CO        CH4
                 O2        NO        SO2       NO2       NH3       HNO3
                 N2        CCl3F     CCl2F2    CClF3     CF4       CHF2Cl
                 C2CL3F3   C2Cl2F4   C2ClF5    ClONO2    HNO4      CHCl2F
                 CCl4      N2O5

 49   27.5      3.83E+00  3.40E+02  6.48E+00  1.23E-01  1.95E-02  8.71E-01
                2.11E+05  1.29E-03  1.56E-05  4.86E-03  9.46E-09  4.87E-03
                7.89E+05  1.06E-05  8.66E-05  1.01E-12  1.01E-12  3.58E-05
                4.88E-06  6.83E-06  1.01E-12  1.22E-03  6.59E-04  1.01E-12
                6.00E-06  8.01E-05
                4.49E+00  3.36E+02  6.06E+00  8.16E-02  1.95E-02  7.18E-01
                2.11E+05  1.29E-03  1.56E-05  4.86E-03  9.46E-09  4.87E-03
                7.89E+05  1.06E-05  8.66E-05  1.01E-12  1.01E-12  3.58E-05
                4.88E-06  6.83E-06  1.01E-12  1.22E-03  6.59E-04  1.01E-12
                6.00E-06  8.01E-05
                5.00E+00  3.34E+02  5.35E+00  7.42E-02  1.87E-02  7.04E-01
                2.11E+05  1.29E-03  1.56E-05  4.86E-03  9.46E-09  4.87E-03
                7.89E+05  1.06E-05  8.66E-05  1.01E-12  1.01E-12  3.58E-05
                4.88E-06  6.83E-06  1.01E-12  1.22E-03  6.59E-04  1.01E-12
                6.00E-06  8.01E-05

 50   30.0      4.00E+00  3.40E+02  7.34E+00  1.07E-01  2.26E-02  7.96E-01
                2.11E+05  2.47E-03  1.35E-05  6.22E-03  6.41E-09  3.78E-03
                7.89E+05  3.94E-06  5.94E-05  1.01E-12  1.01E-12  3.05E-05
                2.94E-06  5.69E-06  1.01E-12  1.15E-03  5.15E-04  1.01E-12
                1.77E-06  5.57E-05
                4.75E+00  3.36E+02  7.07E+00  6.82E-02  2.26E-02  6.43E-01
                2.11E+05  2.47E-03  1.35E-05  6.22E-03  6.41E-09  3.78E-03
                7.89E+05  3.94E-06  5.94E-05  1.01E-12  1.01E-12  3.05E-05
                2.94E-06  5.69E-06  1.01E-12  1.15E-03  5.15E-04  1.01E-12
                1.77E-06  5.57E-05
                5.05E+00  3.34E+02  5.76E+00  6.01E-02  2.05E-02  6.52E-01
                2.11E+05  2.47E-03  1.35E-05  6.22E-03  6.41E-09  3.78E-03
                7.89E+05  3.94E-06  5.94E-05  1.01E-12  1.01E-12  3.05E-05
                2.94E-06  5.69E-06  1.01E-12  1.15E-03  5.15E-04  1.01E-12
                1.77E-06  5.57E-05

 51   32.5      4.10E+00  3.40E+02  8.03E+00  8.55E-02  2.57E-02  7.15E-01
                2.11E+05  4.57E-03  1.22E-05  7.28E-03  3.72E-09  2.62E-03
                7.89E+05  6.09E-07  3.60E-05  1.01E-12  1.01E-12  2.54E-05
                1.42E-06  4.60E-06  1.01E-12  9.55E-04  3.22E-04  1.01E-12
                1.33E-07  2.76E-05
                4.90E+00  3.36E+02  8.18E+00  5.05E-02  2.57E-02  5.70E-01
                2.11E+05  4.57E-03  1.22E-05  7.28E-03  3.72E-09  2.62E-03
                7.89E+05  6.09E-07  3.60E-05  1.01E-12  1.01E-12  2.54E-05
                1.42E-06  4.60E-06  1.01E-12  9.55E-04  3.22E-04  1.01E-12
                1.33E-07  2.76E-05
                5.05E+00  3.34E+02  6.97E+00  4.20E-02  2.26E-02  5.96E-01
                2.11E+05  4.57E-03  1.22E-05  7.28E-03  3.72E-09  2.62E-03
                7.89E+05  6.09E-07  3.60E-05  1.01E-12  1.01E-12  2.54E-05
                1.42E-06  4.60E-06  1.01E-12  9.55E-04  3.22E-04  1.01E-12
                1.33E-07  2.76E-05
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52	35.0	4.50E+00	3.40E+02	8.31E+00	6.68E-02	2.82E-02	6.42E-01
		2.11E+05	7.21E-03	1.17E-05	7.35E-03	1.84E-09	1.66E-03
		7.89E+05	2.00E-07	2.15E-05	1.01E-12	1.01E-12	2.09E-05
		7.24E-07	3.69E-06	1.01E-12	5.29E-04	1.48E-04	1.01E-12
		3.99E-08	1.09E-05				
		5.00E+00	3.36E+02	8.99E+00	3.77E-02	2.82E-02	5.10E-01
		2.11E+05	7.21E-03	1.17E-05	7.35E-03	1.84E-09	1.66E-03
		7.89E+05	2.00E-07	2.15E-05	1.01E-12	1.01E-12	2.09E-05
		7.24E-07	3.69E-06	1.01E-12	5.29E-04	1.48E-04	1.01E-12
		3.99E-08	1.09E-05				
		5.05E+00	3.34E+02	7.78E+00	3.07E-02	2.47E-02	5.30E-01
		2.11E+05	7.21E-03	1.17E-05	7.35E-03	1.84E-09	1.66E-03
		7.89E+05	2.00E-07	2.15E-05	1.01E-12	1.01E-12	2.09E-05
		7.24E-07	3.69E-06	1.01E-12	5.29E-04	1.48E-04	1.01E-12
		3.99E-08	1.09E-05				
53	37.5	4.90E+00	3.40E+02	7.84E+00	4.74E-02	3.09E-02	5.70E-01
		2.11E+05	9.43E-03	1.22E-05	6.32E-03	9.35E-10	9.77E-04
		7.89E+05	2.37E-08	1.21E-05	1.01E-12	1.01E-12	1.72E-05
		3.24E-07	2.95E-06	1.01E-12	2.40E-04	5.31E-05	1.01E-12
		1.73E-09	2.75E-06				
		5.05E+00	3.36E+02	8.78E+00	2.57E-02	3.07E-02	4.54E-01
		2.11E+05	9.43E-03	1.22E-05	6.32E-03	9.35E-10	9.77E-04
		7.89E+05	2.37E-08	1.21E-05	1.01E-12	1.01E-12	1.72E-05
		3.24E-07	2.95E-06	1.01E-12	2.40E-04	5.31E-05	1.01E-12
		1.73E-09	2.75E-06				
		5.05E+00	3.34E+02	7.88E+00	1.97E-02	2.65E-02	4.56E-01
		2.11E+05	9.43E-03	1.22E-05	6.32E-03	9.35E-10	9.77E-04
		7.89E+05	2.37E-08	1.21E-05	1.01E-12	1.01E-12	1.72E-05
		3.24E-07	2.95E-06	1.01E-12	2.40E-04	5.31E-05	1.01E-12
		1.73E-09	2.75E-06				
54	40.0	4.63E+00	3.40E+02	6.81E+00	3.22E-02	3.43E-02	4.92E-01
		2.11E+05	1.13E-02	1.37E-05	4.07E-03	2.97E-10	5.38E-04
		7.89E+05	1.87E-09	6.15E-06	1.01E-12	1.01E-12	1.40E-05
		1.24E-07	2.34E-06	1.01E-12	4.31E-05	1.01E-05	1.01E-12
		4.00E-11	2.15E-07				
		5.15E+00	3.36E+02	7.62E+00	1.77E-02	3.35E-02	3.99E-01
		2.11E+05	1.13E-02	1.37E-05	4.07E-03	2.97E-10	5.38E-04
		7.89E+05	1.87E-09	6.15E-06	1.01E-12	1.01E-12	1.40E-05
		1.24E-07	2.34E-06	1.01E-12	4.31E-05	1.01E-05	1.01E-12
		4.00E-11	2.15E-07				
		5.05E+00	3.34E+02	7.07E+00	1.29E-02	2.83E-02	3.75E-01
		2.11E+05	1.13E-02	1.37E-05	4.07E-03	2.97E-10	5.38E-04
		7.89E+05	1.87E-09	6.15E-06	1.01E-12	1.01E-12	1.40E-05
		1.24E-07	2.34E-06	1.01E-12	4.31E-05	1.01E-05	1.01E-12
		4.00E-11	2.15E-07				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data    ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                 H2O        CO2        O3         N2O        CO         CH4
                 O2         NO         SO2        NO2        NH3        HNO3
                 N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                 C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                 CCl4       N2O5

  55   42.5     5.76E+00   3.40E+02   5.44E+00   2.01E-02   3.76E-02   4.12E-01
                2.11E+05   1.20E-02   1.67E-05   2.19E-03   8.80E-11   2.54E-04
                7.89E+05   7.76E-10   3.87E-06   1.01E-12   1.01E-12   1.21E-05
                7.08E-08   1.96E-06   1.01E-12   1.76E-05   4.48E-06   1.01E-12
                1.55E-11   8.39E-08
                5.35E+00   3.36E+02   5.96E+00   1.18E-02   3.55E-02   3.45E-01
                2.11E+05   1.20E-02   1.67E-05   2.19E-03   8.81E-11   2.54E-04
                7.89E+05   7.76E-10   3.87E-06   1.01E-12   1.01E-12   1.21E-05
                7.08E-08   1.96E-06   1.01E-12   1.76E-05   4.48E-06   1.01E-12
                1.55E-11   8.39E-08
                5.05E+00   3.34E+02   5.45E+00   9.11E-03   3.00E-02   3.03E-01
                2.11E+05   1.20E-02   1.67E-05   2.19E-03   8.81E-11   2.54E-04
                7.89E+05   7.76E-10   3.87E-06   1.01E-12   1.01E-12   1.21E-05
                7.08E-08   1.96E-06   1.01E-12   1.76E-05   4.48E-06   1.01E-12
                1.55E-11   8.39E-08

  56   45.0     6.13E+00   3.40E+02   4.46E+00   1.21E-02   4.13E-02   3.35E-01
                2.11E+05   1.18E-02   2.12E-05   1.16E-03   3.01E-11   1.22E-04
                7.89E+05   9.27E-11   2.15E-06   1.01E-12   1.01E-12   1.05E-05
                3.25E-08   1.63E-06   1.01E-12   1.70E-06   8.82E-07   1.01E-12
                5.63E-13   3.98E-09
                5.50E+00   3.36E+02   4.54E+00   7.81E-03   3.74E-02   2.93E-01
                2.11E+05   1.18E-02   2.12E-05   1.16E-03   3.01E-11   1.22E-04
                7.89E+05   9.27E-11   2.15E-06   1.01E-12   1.01E-12   1.05E-05
                3.25E-08   1.63E-06   1.01E-12   1.70E-06   8.82E-07   1.01E-12
                5.63E-13   3.98E-09
                5.05E+00   3.34E+02   4.24E+00   6.36E-03   3.18E-02   2.47E-01
                2.11E+05   1.18E-02   2.12E-05   1.16E-03   3.01E-11   1.22E-04
                7.89E+05   9.27E-11   2.15E-06   1.01E-12   1.01E-12   1.05E-05
                3.25E-08   1.63E-06   1.01E-12   1.70E-06   8.82E-07   1.01E-12
                5.63E-13   3.98E-09

  57   47.5     6.41E+00   3.40E+02   3.40E+00   7.57E-03   4.51E-02   2.66E-01
                2.11E+05   1.11E-02   2.80E-05   6.72E-04   1.31E-11   7.78E-05
                7.89E+05   2.41E-11   1.28E-06   1.01E-12   1.01E-12   9.42E-06
                1.67E-08   1.40E-06   1.01E-12   3.58E-07   2.60E-07   1.01E-12
                1.11E-13   7.65E-10
                5.55E+00   3.36E+02   3.53E+00   5.42E-03   3.95E-02   2.43E-01
                2.11E+05   1.11E-02   2.80E-05   6.72E-04   1.31E-11   7.78E-05
                7.89E+05   2.41E-11   1.28E-06   1.01E-12   1.01E-12   9.42E-06
                1.67E-08   1.40E-06   1.01E-12   3.58E-07   2.60E-07   1.01E-12
                1.11E-13   7.65E-10
                5.05E+00   3.34E+02   3.23E+00   4.61E-03   3.40E-02   2.02E-01
                2.11E+05   1.11E-02   2.80E-05   6.72E-04   1.31E-11   7.78E-05
                7.89E+05   2.41E-11   1.28E-06   1.01E-12   1.01E-12   9.42E-06
                1.67E-08   1.40E-06   1.01E-12   3.58E-07   2.60E-07   1.01E-12
                1.11E-13   7.65E-10
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---------------------------- Stratopause No. 1/1 ----------------------------
---------------------------- Stratopause No. 2/1 ----------------------------
---------------------------- Stratopause No. 3/1 ----------------------------

58	50.0	6.43E+00	3.40E+02	2.83E+00	4.10E-03	4.95E-02	2.08E-01
		2.11E+05	1.04E-02	3.59E-05	4.47E-04	7.20E-12	5.60E-05
		7.89E+05	6.02E-12	8.60E-07	1.01E-12	1.01E-12	8.87E-06
		1.00E-08	1.26E-06	1.01E-12	4.71E-08	7.70E-08	1.01E-12
		1.10E-14	6.35E-11				
		5.55E+00	3.36E+02	2.83E+00	3.28E-03	4.13E-02	1.98E-01
		2.11E+05	1.04E-02	3.59E-05	4.47E-04	7.20E-12	5.60E-05
		7.89E+05	6.02E-12	8.60E-07	1.01E-12	1.01E-12	8.87E-06
		1.00E-08	1.26E-06	1.01E-12	4.71E-08	7.70E-08	1.01E-12
		1.10E-14	6.35E-11				
		5.00E+00	3.34E+02	2.52E+00	2.83E-03	3.65E-02	1.68E-01
		2.11E+05	1.04E-02	3.59E-05	4.47E-04	7.20E-12	5.60E-05
		7.89E+05	6.02E-12	8.60E-07	1.01E-12	1.01E-12	8.87E-06
		1.00E-08	1.26E-06	1.01E-12	4.71E-08	7.70E-08	1.01E-12
		1.10E-14	6.35E-11				
59	55.0	6.31E+00	3.40E+02	1.82E+00	2.59E-03	5.61E-02	1.66E-01
		2.11E+05	1.02E-02	4.63E-05	3.42E-04	4.85E-12	4.49E-05
		7.89E+05	6.17E-13	4.20E-07	1.01E-12	1.01E-12	8.20E-06
		3.96E-09	1.05E-06	1.01E-12	1.21E-09	6.87E-09	1.01E-12
		3.81E-16	1.05E-12				
		5.40E+00	3.36E+02	1.82E+00	2.07E-03	4.44E-02	1.60E-01
		2.11E+05	1.02E-02	4.63E-05	3.42E-04	4.85E-12	4.49E-05
		7.89E+05	6.17E-13	4.20E-07	1.01E-12	1.01E-12	8.20E-06
		3.96E-09	1.05E-06	1.01E-12	1.21E-09	6.87E-09	1.01E-12
		3.81E-16	1.05E-12				
		4.90E+00	3.34E+02	1.72E+00	1.79E-03	4.13E-02	1.52E-01
		2.11E+05	1.02E-02	4.63E-05	3.42E-04	4.85E-12	4.49E-05
		7.89E+05	6.17E-13	4.20E-07	1.01E-12	1.01E-12	8.20E-06
		3.96E-09	1.05E-06	1.01E-12	1.21E-09	6.87E-09	1.01E-12
		3.81E-16	1.05E-12				
60	60.0	6.11E+00	3.40E+02	1.21E+00	1.78E-03	6.58E-02	1.54E-01
		2.11E+05	1.02E-02	5.20E-05	2.88E-04	3.70E-12	3.88E-05
		7.89E+05	4.28E-14	1.96E-07	1.01E-12	1.01E-12	7.78E-06
		1.43E-09	8.77E-07	1.01E-12	1.73E-11	4.84E-10	1.01E-12
		5.30E-18	5.17E-15				
		5.05E+00	3.36E+02	1.31E+00	1.42E-03	5.29E-02	1.53E-01
		2.11E+05	1.02E-02	5.20E-05	2.88E-04	3.70E-12	3.88E-05
		7.89E+05	4.28E-14	1.96E-07	1.01E-12	1.01E-12	7.78E-06
		1.43E-09	8.77E-07	1.01E-12	1.73E-11	4.84E-10	1.01E-12
		5.30E-18	5.17E-15				
		4.54E+00	3.34E+02	1.21E+00	1.23E-03	5.20E-02	1.52E-01
		2.11E+05	1.02E-02	5.20E-05	2.88E-04	3.70E-12	3.88E-05
		7.89E+05	4.28E-14	1.96E-07	1.01E-12	1.01E-12	7.78E-06
		1.43E-09	8.77E-07	1.01E-12	1.73E-11	4.84E-10	1.01E-12
		5.30E-18	5.17E-15				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data    ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                  H2O         CO2         O3          N2O         CO          CH4
                  O2          NO          SO2         NO2         NH3         HNO3
                  N2          CCl3F       CCl2F2      CClF3       CF4         CHF2Cl
                  C2CL3F3     C2Cl2F4     C2ClF5      ClONO2      HNO4        CHCl2F
                  CCl4        N2O5

  61   65.0       4.80E+00    3.40E+02    7.32E-01    1.30E-03    8.83E-02    1.54E-01
                  2.11E+05    1.04E-02    5.16E-05    2.55E-04    3.03E-12    3.52E-05
                  7.89E+05    5.02E-15    9.13E-08    1.01E-12    1.01E-12    7.50E-06
                  5.32E-10    7.26E-07    1.01E-12    8.65E-13    7.81E-11    1.01E-12
                  2.48E-19    1.37E-16
                  4.44E+00    3.36E+02    8.08E-01    1.04E-03    7.25E-02    1.53E-01
                  2.11E+05    1.04E-02    5.16E-05    2.55E-04    3.03E-12    3.52E-05
                  7.89E+05    5.02E-15    9.13E-08    1.01E-12    1.01E-12    7.50E-06
                  5.32E-10    7.26E-07    1.01E-12    8.65E-13    7.81E-11    1.01E-12
                  2.48E-19    1.37E-16
                  4.04E+00    3.34E+02    8.08E-01    8.97E-04    7.22E-02    1.52E-01
                  2.11E+05    1.04E-02    5.16E-05    2.55E-04    3.03E-12    3.52E-05
                  7.89E+05    5.02E-15    9.13E-08    1.01E-12    1.01E-12    7.50E-06
                  5.32E-10    7.26E-07    1.01E-12    8.65E-13    7.81E-11    1.01E-12
                  2.48E-19    1.37E-16

  62   70.0       3.38E+00    3.40E+02    3.53E-01    9.92E-04    1.76E-01    1.54E-01
                  2.11E+05    1.16E-02    4.36E-05    2.33E-04    2.60E-12    3.30E-05
                  7.89E+05    5.14E-16    3.94E-08    1.01E-12    1.01E-12    7.26E-06
                  1.77E-10    5.91E-07    1.01E-12    7.31E-14    3.24E-11    1.01E-12
                  9.97E-21    8.28E-18
                  3.74E+00    3.36E+02    4.04E-01    7.92E-04    1.33E-01    1.53E-01
                  2.11E+05    1.16E-02    4.36E-05    2.33E-04    2.60E-12    3.30E-05
                  7.89E+05    5.14E-16    3.94E-08    1.01E-12    1.01E-12    7.26E-06
                  1.77E-10    5.91E-07    1.01E-12    7.31E-14    3.24E-11    1.01E-12
                  9.97E-21    8.28E-18
                  3.33E+00    3.34E+02    4.04E-01    6.84E-04    1.33E-01    1.52E-01
                  2.11E+05    1.16E-02    4.36E-05    2.33E-04    2.60E-12    3.30E-05
                  7.89E+05    5.14E-16    3.94E-08    1.01E-12    1.01E-12    7.26E-06
                  1.77E-10    5.91E-07    1.01E-12    7.31E-14    3.24E-11    1.01E-12
                  9.97E-21    8.28E-18

  63   75.0       3.02E+00    3.40E+02    1.87E-01    7.80E-04    4.88E-01    1.54E-01
                  2.11E+05    1.63E-02    2.86E-05    2.17E-04    2.29E-12    3.15E-05
                  7.89E+05    4.28E-17    1.54E-08    1.01E-12    1.01E-12    6.98E-06
                  5.19E-11    4.69E-07    1.01E-12    5.47E-15    1.28E-11    1.01E-12
                  3.08E-22    7.33E-19
                  2.98E+00    3.36E+02    1.92E-01    6.38E-04    3.32E-01    1.53E-01
                  2.11E+05    1.63E-02    2.86E-05    2.17E-04    2.29E-12    3.15E-05
                  7.89E+05    4.28E-17    1.54E-08    1.01E-12    1.01E-12    6.98E-06
                  5.19E-11    4.69E-07    1.01E-12    5.47E-15    1.28E-11    1.01E-12
                  3.08E-22    7.33E-19
                  2.73E+00    3.34E+02    2.02E-01    5.60E-04    3.43E-01    1.52E-01
                  2.11E+05    1.63E-02    2.86E-05    2.17E-04    2.29E-12    3.15E-05
                  7.89E+05    4.28E-17    1.54E-08    1.01E-12    1.01E-12    6.98E-06
                  5.19E-11    4.69E-07    1.01E-12    5.47E-15    1.28E-11    1.01E-12
                  3.08E-22    7.33E-19
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64	80.0	2.12E+00	3.38E+02	2.68E-01	6.29E-04	1.26E+00	1.54E-01
		2.11E+05	2.71E-02	1.34E-05	2.04E-04	2.06E-12	3.04E-05
		7.89E+05	2.00E-18	5.24E-09	1.01E-12	1.01E-12	6.58E-06
		1.24E-11	3.58E-07	1.01E-12	4.08E-17	8.51E-13	1.01E-12
		2.96E-24	5.14E-21				
		2.12E+00	3.34E+02	2.02E-01	5.26E-04	7.72E-01	1.53E-01
		2.11E+05	2.71E-02	1.34E-05	2.04E-04	2.06E-12	3.04E-05
		7.89E+05	2.00E-18	5.24E-09	1.01E-12	1.01E-12	6.58E-06
		1.24E-11	3.58E-07	1.01E-12	4.08E-17	8.51E-13	1.01E-12
		2.96E-24	5.14E-21				
		2.02E+00	3.32E+02	1.82E-01	4.71E-04	8.94E-01	1.52E-01
		2.11E+05	2.71E-02	1.34E-05	2.04E-04	2.06E-12	3.04E-05
		7.89E+05	2.00E-18	5.24E-09	1.01E-12	1.01E-12	6.58E-06
		1.24E-11	3.58E-07	1.01E-12	4.08E-17	8.51E-13	1.01E-12
		2.96E-24	5.14E-21				
65	85.0	1.32E+00	3.33E+02	5.45E-01	5.23E-04	3.04E+00	1.56E-01
		2.04E+05	7.14E-02	5.67E-06	1.96E-04	1.89E-12	2.98E-05
		7.96E+05	1.90E-19	1.86E-09	1.02E-12	1.02E-12	5.95E-06
		3.33E-12	2.58E-07	1.02E-12	3.87E-20	1.92E-15	1.02E-12
		1.13E-25	4.04E-24				
		1.36E+00	3.29E+02	5.81E-01	4.48E-04	1.67E+00	1.54E-01
		2.04E+05	7.14E-02	5.67E-06	1.96E-04	1.89E-12	2.98E-05
		7.96E+05	1.90E-19	1.86E-09	1.02E-12	1.02E-12	5.95E-06
		3.33E-12	2.58E-07	1.02E-12	3.87E-20	1.92E-15	1.02E-12
		1.13E-25	4.04E-24				
		1.36E+00	3.27E+02	6.62E-01	4.06E-04	2.08E+00	1.53E-01
		2.04E+05	7.14E-02	5.67E-06	1.96E-04	1.89E-12	2.98E-05
		7.96E+05	1.90E-19	1.86E-09	1.02E-12	1.02E-12	5.95E-06
		3.33E-12	2.58E-07	1.02E-12	3.87E-20	1.92E-15	1.02E-12
		1.13E-25	4.04E-24				

------------------------------ Mesopause No. 1/1 ----------------------------

------------------------------ Mesopause No. 2/1 ----------------------------

------------------------------ Mesopause No. 3/1 ----------------------------

66	90.0	8.76E-01	3.26E+02	6.54E-01	4.43E-04	5.45E+00	1.47E-01
		1.96E+05	2.20E-01	2.31E-06	1.89E-04	1.76E-12	2.93E-05
		8.04E+05	1.59E-20	5.84E-10	1.03E-12	1.03E-12	4.94E-06
		7.67E-13	1.64E-07	1.03E-12	1.21E-22	1.79E-18	1.03E-12
		3.72E-27	2.47E-27				
		8.76E-01	3.22E+02	7.73E-01	3.88E-04	3.29E+00	1.46E-01
		1.96E+05	2.20E-01	2.31E-06	1.89E-04	1.76E-12	2.93E-05
		8.04E+05	1.59E-20	5.84E-10	1.03E-12	1.03E-12	4.94E-06
		7.67E-13	1.64E-07	1.03E-12	1.21E-22	1.79E-18	1.03E-12
		3.72E-27	2.47E-27				
		8.76E-01	3.20E+02	9.28E-01	3.57E-04	3.93E+00	1.45E-01
		1.96E+05	2.20E-01	2.31E-06	1.89E-04	1.76E-12	2.93E-05
		8.04E+05	1.59E-20	5.84E-10	1.03E-12	1.03E-12	4.94E-06
		7.67E-13	1.64E-07	1.03E-12	1.21E-22	1.79E-18	1.03E-12
		3.72E-27	2.47E-27				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data     ****************

Layer Altitude   ------------ Molecular Concentrations (ppmv) -------------
                  H2O        CO2        O3         N2O        CO         CH4
                  O2         NO         SO2        NO2        NH3        HNO3
                  N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                  C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                  CCl4       N2O5

  67  95.0        5.63E-01   2.87E+02   6.25E-01   3.81E-04   9.12E+00   1.38E-01
                  1.88E+05   7.42E-01   9.34E-07   1.83E-04   1.66E-12   2.90E-05
                  8.12E+05   1.06E-21   1.51E-10   1.04E-12   1.04E-12   3.50E-06
                  1.40E-13   8.01E-08   1.04E-12   9.04E-25   4.66E-21   1.04E-12
                  9.16E-29   8.74E-30
                  5.63E-01   2.84E+02   7.30E-01   3.41E-04   6.04E+00   1.37E-01
                  1.88E+05   7.42E-01   9.34E-07   1.83E-04   1.66E-12   2.90E-05
                  8.12E+05   1.06E-21   1.51E-10   1.04E-12   1.04E-12   3.50E-06
                  1.40E-13   8.01E-08   1.04E-12   9.04E-25   4.66E-21   1.04E-12
                  9.16E-29   8.74E-30
                  5.63E-01   2.82E+02   8.34E-01   3.18E-04   6.91E+00   1.36E-01
                  1.88E+05   7.42E-01   9.34E-07   1.83E-04   1.66E-12   2.90E-05
                  8.12E+05   1.06E-21   1.51E-10   1.04E-12   1.04E-12   3.50E-06
                  1.40E-13   8.01E-08   1.04E-12   9.04E-25   4.66E-21   1.04E-12
                  9.16E-29   8.74E-30

  68  100.        4.27E-01   2.12E+02   4.27E-01   3.36E-04   1.62E+01   1.31E-01
                  1.71E+05   2.22E+00   3.82E-07   1.81E-04   1.58E-12   2.91E-05
                  8.29E+05   3.32E-23   2.65E-11   1.07E-12   1.07E-12   1.91E-06
                  1.40E-14   2.27E-08   1.07E-12   8.62E-28   3.55E-24   1.07E-12
                  5.44E-31   0.00E+00
                  4.27E-01   2.10E+02   4.27E-01   3.06E-04   1.21E+01   1.29E-01
                  1.71E+05   2.22E+00   3.82E-07   1.81E-04   1.58E-12   2.91E-05
                  8.29E+05   3.32E-23   2.65E-11   1.07E-12   1.07E-12   1.91E-06
                  1.40E-14   2.27E-08   1.07E-12   8.62E-28   3.55E-24   1.07E-12
                  5.44E-31   0.00E+00
                  4.27E-01   2.09E+02   4.27E-01   2.90E-04   1.25E+01   1.28E-01
                  1.71E+05   2.22E+00   3.82E-07   1.81E-04   1.58E-12   2.91E-05
                  8.29E+05   3.32E-23   2.65E-11   1.07E-12   1.07E-12   1.91E-06
                  1.40E-14   2.27E-08   1.07E-12   8.62E-28   3.55E-24   1.07E-12
                  5.44E-31   0.00E+00

  69  105.        3.72E-01   1.23E+02   2.19E-01   2.99E-04   2.66E+01   1.23E-01
                  1.53E+05   4.92E+00   1.56E-07   1.79E-04   1.53E-12   2.93E-05
                  8.47E+05   2.27E-24   4.71E-12   1.09E-12   1.09E-12   7.81E-07
                  1.35E-15   3.84E-09   1.09E-12   9.23E-30   6.90E-26   1.09E-12
                  1.49E-32   0.00E+00
                  3.72E-01   1.21E+02   2.19E-01   2.79E-04   2.29E+01   1.21E-01
                  1.53E+05   4.92E+00   1.56E-07   1.79E-04   1.53E-12   2.93E-05
                  8.47E+05   2.27E-24   4.71E-12   1.09E-12   1.09E-12   7.81E-07
                  1.35E-15   3.84E-09   1.09E-12   9.23E-30   6.90E-26   1.09E-12
                  1.49E-32   0.00E+00
                  3.72E-01   1.21E+02   2.19E-01   2.67E-04   2.31E+01   1.21E-01
                  1.53E+05   4.92E+00   1.56E-07   1.79E-04   1.53E-12   2.93E-05
                  8.47E+05   2.27E-24   4.71E-12   1.09E-12   1.09E-12   7.81E-07
                  1.35E-15   3.84E-09   1.09E-12   9.23E-30   6.90E-26   1.09E-12
                  1.49E-32   0.00E+00
```

70	110.	3.15E-01	6.88E+01	5.62E-02	2.69E-04	3.92E+01	1.09E-01
		1.35E+05	8.97E+00	6.44E-08	1.79E-04	1.48E-12	2.97E-05
		8.65E+05	1.52E-25	6.90E-13	1.12E-12	1.12E-12	2.51E-07
		8.84E-17	3.90E-10	1.12E-12	8.54E-32	1.71E-27	1.12E-12
		0.00E+00	0.00E+00				
		3.15E-01	6.80E+01	5.62E-02	2.56E-04	3.61E+01	1.08E-01
		1.35E+05	8.97E+00	6.44E-08	1.79E-04	1.48E-12	2.97E-05
		8.65E+05	1.52E-25	6.90E-13	1.12E-12	1.12E-12	2.51E-07
		8.84E-17	3.90E-10	1.12E-12	8.54E-32	1.71E-27	1.12E-12
		0.00E+00	0.00E+00				
		3.15E-01	6.76E+01	5.62E-02	2.49E-04	3.61E+01	1.07E-01
		1.35E+05	8.97E+00	6.44E-08	1.79E-04	1.48E-12	2.97E-05
		8.65E+05	1.52E-25	6.90E-13	1.12E-12	1.12E-12	2.51E-07
		8.84E-17	3.90E-10	1.12E-12	8.54E-32	1.71E-27	1.12E-12
		0.00E+00	0.00E+00				
71	115.	2.79E-01	4.75E+01	5.82E-03	2.47E-04	5.25E+01	7.12E-02
		1.09E+05	1.16E+01	2.67E-08	1.80E-04	1.46E-12	3.03E-05
		8.90E+05	8.42E-27	7.70E-14	1.16E-12	1.16E-12	6.82E-08
		2.71E-18	1.88E-11	1.16E-12	0.00E+00	4.12E-29	1.16E-12
		0.00E+00	0.00E+00				
		2.79E-01	4.70E+01	5.82E-03	2.40E-04	5.08E+01	7.05E-02
		1.09E+05	1.16E+01	2.67E-08	1.80E-04	1.46E-12	3.03E-05
		8.90E+05	8.42E-27	7.70E-14	1.16E-12	1.16E-12	6.82E-08
		2.71E-18	1.88E-11	1.16E-12	0.00E+00	4.12E-29	1.16E-12
		0.00E+00	0.00E+00				
		2.79E-01	4.67E+01	5.82E-03	2.35E-04	5.08E+01	7.00E-02
		1.09E+05	1.16E+01	2.67E-08	1.80E-04	1.46E-12	3.03E-05
		8.90E+05	8.42E-27	7.70E-14	1.16E-12	1.16E-12	6.82E-08
		2.71E-18	1.88E-11	1.16E-12	0.00E+00	4.12E-29	1.16E-12
		0.00E+00	0.00E+00				
72	120.	2.40E-01	4.29E+01	6.01E-04	2.27E-04	6.73E+01	3.68E-02
		8.71E+04	1.20E+01	1.10E-08	1.81E-04	1.43E-12	3.09E-05
		9.13E+05	6.69E-28	1.15E-14	1.20E-12	1.20E-12	2.31E-08
		9.50E-20	1.08E-12	1.20E-12	0.00E+00	2.69E-30	1.20E-12
		0.00E+00	0.00E+00				
		2.40E-01	4.24E+01	6.01E-04	2.24E-04	6.73E+01	3.64E-02
		8.71E+04	1.20E+01	1.10E-08	1.81E-04	1.43E-12	3.09E-05
		9.13E+05	6.69E-28	1.15E-14	1.20E-12	1.20E-12	2.31E-08
		9.50E-20	1.08E-12	1.20E-12	0.00E+00	2.69E-30	1.20E-12
		0.00E+00	0.00E+00				
		2.40E-01	4.21E+01	6.01E-04	2.23E-04	6.73E+01	3.61E-02
		8.71E+04	1.20E+01	1.10E-08	1.81E-04	1.43E-12	3.09E-05
		9.13E+05	6.69E-28	1.15E-14	1.20E-12	1.20E-12	2.31E-08
		9.50E-20	1.08E-12	1.20E-12	0.00E+00	2.69E-30	1.20E-12
		0.00E+00	0.00E+00				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data    ****************

Layer Altitude   ------------ Molecular Concentrations (ppmv) -------------
                 H2O        CO2        O3         N2O        CO         CH4
                 O2         NO         SO2        NO2        NH3        HNO3
                 N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                 C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                 CCl4       N2O5

 73  130.        0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00

 74  150.        0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00

 75  200.        0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
```

76	250.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
77	400.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
78	500.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				

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Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

****************    Molecular Concentrations Profile Data    ****************

Layer Altitude  ------------ Molecular Concentrations (ppmv) -------------
                 H2O        CO2        O3         N2O        CO         CH4
                 O2         NO         SO2        NO2        NH3        HNO3
                 N2         CCl3F      CCl2F2     CClF3      CF4        CHF2Cl
                 C2CL3F3    C2Cl2F4    C2ClF5     ClONO2     HNO4       CHCl2F
                 CCl4       N2O5

  79 1.000E+03   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00

  80 1.001E+03   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00

  81 1.000E+05   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
                 0.00E+00   0.00E+00
```

82	3.736E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
83	1.490E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		0.00E+00	0.00E+00				

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Earth Background Summary: Longitude = -100.00 deg

Global Backgrounds

Material Type	Temperature (K)					
	Sunlit North East	Shade South West	Sunlit North East	Shade South West	Sunlit North East	Shade South West
	1		2		3	
1 Fr. Water	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
2 Sea Water	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
3 MOD. Ocean	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
4 GEN. Ocean	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
5 FirstYrIce	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
6 MultiYrIce	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
7 Dry Snow	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
8 Wet Snow	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
9 MOD. Snow	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
10 GEN.FrSnow	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
11 GEN.OldSnw	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
12 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
13 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
14 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
15 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
16 MOD. Cloud	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
17 Blackbody	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
18 Whitebody	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Earth Background Summary: Longitude = -100.00 deg

Global Backgrounds

Material Type	Temperature (K) Sunlit North East 1	Shade South West 1	Sunlit North East 2	Shade South West 2	Sunlit North East 3	Shade South West 3
19 Still Air	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
20 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
21 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
22 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
23 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
24 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
25 Undefined	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
26 Dry Grass	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
27 MOD. Grass	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
28 MOD.Dd Grs	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52
	300.20	300.20	292.01	292.01	284.52	284.52

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Latitude  =     50.000 deg North
Longitude =    100.000 deg West
Date      = 21 Jun 1991
Time      = 12:00:00.0 (LST)

Model No. 1/1:  Subtropical (30 N. Lat.) July Atmosphere
                  Exospheric temperature = 1000.0 K
                  Rural Boundary Layer Aerosol Model (Visibility = 18.9 km)
                  Air temperature          =     300.20 K
                  Current wind speed       =       4.10 m/sec
Model No. 2/1:  Midlatitude (45 N. Lat.) Summer Atmosphere
                  Exospheric temperature = 1000.0 K
                  Rural Boundary Layer Aerosol Model (Visibility = 16.6 km)
                  Air temperature          =     292.01 K
                  Current wind speed       =       4.10 m/sec
Model No. 3/1:  Subarctic (60 N. Lat.) Summer Atmosphere
                  Exospheric temperature = 1000.0 K
                  Rural Boundary Layer Aerosol Model (Visibility = 16.8 km)
                  Air temperature          =     284.52 K
                  Current wind speed       =       6.69 m/sec

Background Stratospheric Aerosol Model (Temp.Dep.)
Shettle/Fenn Background Summer Aerosol Profile
Normal Upper Atmosphere Aerosol Profile
Standard boundary layer vertical structure

Terrain type - Global Backgrounds
  Terrain altitude          =      0.487 km
  Surface turbulence, Cn2 =  1.000E-14 m**-2/3
  Av. hi alt. wind speed  =      27.00 m/sec
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Model Atmosphere No. 1/1:	Total	Low Etage	Middle Etage	High Etage
Cloud cover :	24.94 %	5.65 %	14.51 %	4.78 %
Cloud base altitude:		1.23 km	3.24 km	8.91 km
Cloud top altitude :		1.73 km	3.74 km	9.41 km

Model Atmosphere No. 2/1:	Total	Low Etage	Middle Etage	High Etage
Cloud cover :	41.60 %	4.00 %	24.40 %	13.40 %
Cloud base altitude:		1.50 km	3.74 km	8.33 km
Cloud top altitude :		2.00 km	4.24 km	8.83 km

Model Atmosphere No. 3/1:	Total	Low Etage	Middle Etage	High Etage
Cloud cover :	53.40 %	10.00 %	32.40 %	10.80 %
Cloud base altitude:		1.50 km	3.60 km	6.40 km
Cloud top altitude :		2.00 km	4.10 km	6.90 km

No clouds, fog, rain, or snow models

Source-based coordinate reference frame

No solar calculations

No lunar calculations

Geometry Conditions (12 positions)

No		Observer Altitude (km)	Src/Tang Altitude (km)	Slant Range (km)	Earth Center Angle (deg)	Obs. Look Angle (deg)	Src. Look Angle (deg)
1	Se	100.00	1.00	1049.97	9.35	-10.01	1.00
2	Be	100.00		99.52	0.00	-90.00	
3	Ce	100.00	1.00	99.01	0.00	-90.00	90.00
4	Ce	100.00	88.56	120.00	1.06	-6.00	4.94
5	Cz	100.00	1.00	99.01	0.00	180.00	0.00
6	Cl	100.00	1.00	477.71	4.18	-14.03	9.93
						Lat: 46.00	Lon: -98.20
7	Ae	1.00					
8	He	1.00		1.00	0.01		
9	Le	400.00	349.57			-7.00	
10	Le	100.00	1.00			-9.96	
11	Le	400.00	-200.00			-24.28	
12	Le	400.00	0.38			-19.75	

No forward in-scattered transmittance calculated
Background material temperatures set to local air temperature
1 cm**-1 band parameters used
Single scattering calculations only

File root name - test
Input file - .in
ASCII output file - .out

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.      1 Spectral Bin No.     1
Basic Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or     3.333 to     3.333 um
Wavenumber increment =     5.0 cm-1
Equiv.Bandwidth =     5.0 cm-1 (    0.0056 um)  Square response

Source (only) calculations


Observer altitude                    =     100.     km.
Observer elevation angle             =    -10.0     deg.
Source altitude                      =     1.00     km.
Source elevation angle               =    0.999     deg.
Observer-Source slant range          =    1.050E+03 km.
Observer-Source grnd. range          =    1.039E+03 km.
Observer-Source earth center angle =      9.35     deg.

 Azimuth -------------------------Source (w/cm**2/sr)------------------------
  (deg) Transmit. Scintill.           Solr+Lunr   Em.Path    Sc.Path Path StDv


    0.0 5.174E-06 1.523E+00           0.000E+00 5.557E-09 0.000E+00 8.135E-14
   90.0 5.515E-06 1.523E+00           0.000E+00 5.491E-09 0.000E+00 8.095E-14
  180.0 5.887E-06 1.523E+00           0.000E+00 5.421E-09 0.000E+00 8.002E-14
  270.0 5.515E-06 1.523E+00           0.000E+00 5.491E-09 0.000E+00 8.095E-14

No skyshine
```

Sample Input File

```
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.     1 Spectral Bin No.     1
Source Atmospheric Conditions (Source alt. =     1.00 km)

Freq.range  3000.0 to  3000.0 cm-1 or     3.333 to     3.333 um
Wavenumber increment =     5.0 cm-1
Equiv.Bandwidth =     5.0 cm-1 (    0.0056 um)  Square response

Source (only) calculations


Azim.  (deg):       0.0      90.0     180.0     270.0

Press.  (mb):     900.0     900.0     900.0     900.0
Pr.alt. (km):      0.99      0.99      0.99      0.99
Temp.    (K):     287.0     287.0     287.0     287.0
RH (wtr) (%):      68.2      68.2      68.2      68.2
RH (ice) (%):      68.2      68.2      68.2      68.2

H2O    (ppmv):  12052.2   12052.2   12052.2   12052.2
CO2    (ppmv):    331.5     331.5     331.5     331.5
O3     (ppmv):    0.032     0.032     0.032     0.032
N2O    (ppmv):    0.318     0.318     0.318     0.318
CO     (ppmv):    0.162     0.162     0.162     0.162
CH4    (ppmv):    1.707     1.707     1.707     1.707
O2     (ppmv):  208496.   208496.   208496.   208496.
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 2 Spectral Bin No. 1
Basic Radiative Environment

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Background (only) calculations

Observer altitude	=	100.	km.
Observer elevation angle	=	-90.0	deg.
Terrain altitude	=	0.487	km.
Background elevation angle	=	90.0	deg.
Obsv-Background slant range	=	99.5	km.
Obsv-Background grnd. range	=	0.000E+00	km.
Obsv-Background earth center angle	=	0.000E+00	deg.

Azimuth		Background (w/cm**2/sr)					
(deg)	Type	Emission	Reflection	Em.Path	Sc.Path	Bkgd.StDv	Path StDv
0.0	Forest/Agr	1.626E-11	0.000E+00	1.137E-08	0.000E+00	6.387E-10	2.604E-11
90.0	Forest/Agr	1.626E-11	0.000E+00	1.137E-08	0.000E+00	6.387E-10	2.604E-11
180.0	Forest/Agr	1.626E-11	0.000E+00	1.137E-08	0.000E+00	6.387E-10	2.604E-11
270.0	Forest/Agr	1.626E-11	0.000E+00	1.137E-08	0.000E+00	6.387E-10	2.604E-11

No skyshine

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 2 Spectral Bin No. 1
Terrain Material Summary

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Background (only) calculations

0.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

90.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

180.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

270.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.      2 Spectral Bin No.      1
Background Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or      3.333 to      3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

Background (only) calculations

Observer altitude                      =     100.     km.
Observer elevation angle               =     -90.0    deg.
Terrain altitude                       =     0.487    km.
Background elevation angle             =      90.0    deg.
Obsv-Background slant range            =      99.5    km.
Obsv-Background grnd. range            =    0.000E+00 km.
Obsv-Background earth center angle =    0.000E+00 deg.


Foreground altitudes selected


Alt.  Azim Trans. Scint.          Path Radiance Std.Dev.  Solar/Lunar   Skyshine
(km)  (deg)                       -----(w/cm**2/sr)------ ------(w/cm**2)--------

  0.5    0.0 0.468   0.183          1.137E-08    2.604E-11   0.000E+00    0.000E+00
        90.0 0.468   0.183          1.137E-08    2.604E-11   0.000E+00    0.000E+00
       180.0 0.468   0.183          1.137E-08    2.604E-11   0.000E+00    0.000E+00
       270.0 0.468   0.183          1.137E-08    2.604E-11   0.000E+00    0.000E+00
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 3 Spectral Bin No. 1
Basic Radiative Environment

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Source and background calculations

Observer altitude	=	100.	km.
Observer elevation angle	=	-90.0	deg.
Source altitude	=	1.00	km.
Source elevation angle	=	90.0	deg.
Observer-Source slant range	=	99.0	km.
Observer-Source grnd. range	=	0.000E+00	km.
Observer-Source earth center angle	=	0.000E+00	deg.
Terrain altitude	=	0.487	km.
Background elevation angle	=	90.0	deg.
Obsv-Background slant range	=	99.5	km.
Obsv-Background grnd. range	=	0.000E+00	km.
Obsv-Background earth center angle	=	0.000E+00	deg.
Tangent altitude	=	0.487	km

Azimuth (deg)	Transmit.	Scintill.	Source (w/cm**2/sr) Solr+Lunr	Em.Path	Sc.Path	Path StDv
0.0	5.278E-01	1.767E-01	0.000E+00	8.549E-09	0.000E+00	3.742E-13
90.0	5.278E-01	1.767E-01	0.000E+00	8.549E-09	0.000E+00	3.742E-13
180.0	5.278E-01	1.767E-01	0.000E+00	8.549E-09	0.000E+00	3.742E-13
270.0	5.278E-01	1.767E-01	0.000E+00	8.549E-09	0.000E+00	3.742E-13

Azimuth (deg)	Type	Background (w/cm**2/sr) Emission	Reflection	Em.Path	Sc.Path	Bkgd.StDv	Path StDv
0.0	Forest/Agr	1.626E-11	0.000E+00	1.137E-08	0.000E+00	6.387E-10	2.604E-11
90.0	Forest/Agr	1.626E-11	0.000E+00	1.137E-08	0.000E+00	6.387E-10	2.604E-11
180.0	Forest/Agr	1.626E-11	0.000E+00	1.137E-08	0.000E+00	6.387E-10	2.604E-11
270.0	Forest/Agr	1.626E-11	0.000E+00	1.137E-08	0.000E+00	6.387E-10	2.604E-11

No skyshine

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 3 Spectral Bin No. 1
Source Atmospheric Conditions (Source alt. = 1.00 km)

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Source and background calculations

Azim. (deg):	0.0	90.0	180.0	270.0
Press. (mb):	900.0	900.0	900.0	900.0
Pr.alt. (km):	0.99	0.99	0.99	0.99
Temp. (K):	287.0	287.0	287.0	287.0
RH (wtr) (%):	68.2	68.2	68.2	68.2
RH (ice) (%):	68.2	68.2	68.2	68.2
H2O (ppmv):	12052.2	12052.2	12052.2	12052.2
CO2 (ppmv):	331.5	331.5	331.5	331.5
O3 (ppmv):	0.032	0.032	0.032	0.032
N2O (ppmv):	0.318	0.318	0.318	0.318
CO (ppmv):	0.162	0.162	0.162	0.162
CH4 (ppmv):	1.707	1.707	1.707	1.707
O2 (ppmv):	208496.	208496.	208496.	208496.

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 3 Spectral Bin No. 1
Terrain Material Summary

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Source and background calculations

0.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

90.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

180.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

270.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 3 Spectral Bin No. 1
Background Radiative Environment

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Source and background calculations

Observer altitude	=	100.	km.
Observer elevation angle	=	-90.0	deg.
Terrain altitude	=	0.487	km.
Background elevation angle	=	90.0	deg.
Obsv-Background slant range	=	99.5	km.
Obsv-Background grnd. range	=	0.000E+00	km.
Obsv-Background earth center angle	=	0.000E+00	deg.
Tangent altitude	=	0.487	km.

Foreground altitudes selected

Alt. (km)	Azim (deg)	Trans.	Scint.	Path Radiance -----(w/cm**2/sr)	Std.Dev. ------	Solar/Lunar ------(w/cm**2)	Skyshine --------
0.5	0.0	0.468	0.183	1.137E-08	2.604E-11	0.000E+00	0.000E+00
	90.0	0.468	0.183	1.137E-08	2.604E-11	0.000E+00	0.000E+00
	180.0	0.468	0.183	1.137E-08	2.604E-11	0.000E+00	0.000E+00
	270.0	0.468	0.183	1.137E-08	2.604E-11	0.000E+00	0.000E+00

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.     4 Spectral Bin No.     1
Basic Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or     3.333 to     3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

Source and background calculations


Observer altitude                         =     100.     km.
Observer elevation angle                  =    -6.00     deg.
Source altitude                           =     88.6     km.
Source elevation angle                    =     4.94     deg.
Observer-Source slant range               =     120.     km.
Observer-Source grnd. range               =     118.     km.
Observer-Source earth center angle =           1.06     deg.
Terrain altitude                          =    0.487     km.
Background elevation angle                =    -90.0     deg.
Obsv-Background slant range               =  1.490E+08 km.
Obsv-Background grnd. range               =  1.067E+04 km.
Obsv-Background earth center angle =           96.0     deg.
Tangent altitude                          =     64.6     km

 Azimuth -------------------------Source (w/cm**2/sr)------------------------
  (deg) Transmit. Scintill.          Solr+Lunr    Em.Path    Sc.Path Path StDv


    0.0 1.000E+00 0.000E+00          0.000E+00 0.000E+00 0.000E+00 0.000E+00
   90.0 1.000E+00 0.000E+00          0.000E+00 0.000E+00 0.000E+00 0.000E+00
  180.0 1.000E+00 0.000E+00          0.000E+00 0.000E+00 0.000E+00 0.000E+00
  270.0 1.000E+00 0.000E+00          0.000E+00 0.000E+00 0.000E+00 0.000E+00

 Azimuth -----------------------Background (w/cm**2/sr)-----------------------
  (deg)     Type    Emission Reflection   Em.Path   Sc.Path Bkgd.StDv Path StDv


    0.0     Sky     9.416E-14 0.000E+00 1.552E-12 0.000E+00 0.000E+00 0.000E+00
   90.0     Sky     1.185E-14 0.000E+00 1.546E-12 0.000E+00 0.000E+00 0.000E+00
  180.0     Sky     8.952E-14 0.000E+00 1.531E-12 0.000E+00 0.000E+00 0.000E+00
  270.0     Sky     3.635E-13 0.000E+00 1.546E-12 0.000E+00 0.000E+00 0.000E+00

No skyshine
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 4 Spectral Bin No. 1
Source Atmospheric Conditions (Source alt. = 88.56 km)

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Source and background calculations

Azim. (deg):	0.0	90.0	180.0	270.0
Press. (mb):	0.0	0.0	0.0	0.0
Temp. (K):	163.9	163.9	163.9	163.9
RH (wtr) (%):	0.0	0.0	0.0	0.0
RH (ice) (%):	0.1	0.1	0.1	0.1
H2O (ppmv):	1.0	1.0	1.0	1.0
CO2 (ppmv):	312.9	312.9	312.9	312.9
O3 (ppmv):	0.735	0.735	0.735	0.735
N2O (ppmv):	0.000	0.000	0.000	0.000
CO (ppmv):	2.515	2.515	2.515	2.515
CH4 (ppmv):	0.143	0.143	0.143	0.143
O2 (ppmv):	192834.	192834.	192834.	192834.

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

```
Geometry No.      5 Spectral Bin No.      1
Basic Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or      3.333 to      3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

Source and background calculations

Observer altitude                      =     100.      km.
Observer zenith angle                  =     180.      deg.
Source altitude                        =     1.00      km.
Source zenith angle                    =    0.000E+00 deg.
Observer-Source slant range            =     99.0      km.
Observer-Source grnd. range            =    0.000E+00 km.
Observer-Source earth center angle =    0.000E+00 deg.
Terrain altitude                       =    0.487      km.
Background zenith angle                =    0.000E+00 deg.
Obsv-Background slant range            =     99.5      km.
Obsv-Background grnd. range            =    0.000E+00 km.
Obsv-Background earth center angle =    0.000E+00 deg.
Tangent altitude                       =    0.487      km

 Azimuth -------------------------Source (w/cm**2/sr)------------------------
  (deg) Transmit. Scintill.           Solr+Lunr   Em.Path    Sc.Path Path StDv


    0.0 5.278E-01 1.767E-01           0.000E+00 8.549E-09 0.000E+00 3.742E-13
   90.0 5.278E-01 1.767E-01           0.000E+00 8.549E-09 0.000E+00 3.742E-13
  180.0 5.278E-01 1.767E-01           0.000E+00 8.549E-09 0.000E+00 3.742E-13
  270.0 5.278E-01 1.767E-01           0.000E+00 8.549E-09 0.000E+00 3.742E-13

 Azimuth -----------------------Background (w/cm**2/sr)-----------------------
  (deg)     Type    Emission Reflection   Em.Path   Sc.Path Bkgd.StDv Path StDv


    0.0 Forest/Agr 1.626E-11 0.000E+00 1.137E-08 0.000E+00 6.387E-10 2.604E-11
   90.0 Forest/Agr 1.626E-11 0.000E+00 1.137E-08 0.000E+00 6.387E-10 2.604E-11
  180.0 Forest/Agr 1.626E-11 0.000E+00 1.137E-08 0.000E+00 6.387E-10 2.604E-11
  270.0 Forest/Agr 1.626E-11 0.000E+00 1.137E-08 0.000E+00 6.387E-10 2.604E-11

No skyshine
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 5 Spectral Bin No. 1
Source Atmospheric Conditions (Source alt. = 1.00 km)

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Source and background calculations

Azim. (deg):	0.0	90.0	180.0	270.0
Press. (mb):	900.0	900.0	900.0	900.0
Pr.alt. (km):	0.99	0.99	0.99	0.99
Temp. (K):	287.0	287.0	287.0	287.0
RH (wtr) (%):	68.2	68.2	68.2	68.2
RH (ice) (%):	68.2	68.2	68.2	68.2
H2O (ppmv):	12052.2	12052.2	12052.2	12052.2
CO2 (ppmv):	331.5	331.5	331.5	331.5
O3 (ppmv):	0.032	0.032	0.032	0.032
N2O (ppmv):	0.318	0.318	0.318	0.318
CO (ppmv):	0.162	0.162	0.162	0.162
CH4 (ppmv):	1.707	1.707	1.707	1.707
O2 (ppmv):	208496.	208496.	208496.	208496.

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 5 Spectral Bin No. 1
Terrain Material Summary

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Source and background calculations

0.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

90.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

180.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

270.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4387E-08	2.4387E-08	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.4019E-08	2.4019E-08	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.5097E-08	2.5097E-08	-1.900	800.000	1.650

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.     5 Spectral Bin No.     1
Background Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or     3.333 to     3.333 um
Wavenumber increment =     5.0 cm-1
Equiv.Bandwidth =     5.0 cm-1 (    0.0056 um)  Square response

Source and background calculations

Observer altitude                    =     100.     km.
Observer zenith angle                =     180.     deg.
Terrain altitude                     =    0.487     km.
Background zenith angle              =    0.000E+00 deg.
Obsv-Background slant range          =     99.5     km.
Obsv-Background grnd. range          =    0.000E+00 km.
Obsv-Background earth center angle =    0.000E+00 deg.

Tangent altitude                     =    0.487     km.

Foreground altitudes selected


Alt.  Azim Trans. Scint.        Path Radiance Std.Dev.  Solar/Lunar   Skyshine
(km)  (deg)                     -----(w/cm**2/sr)------ ------(w/cm**2)--------

  0.5    0.0 0.468  0.183         1.137E-08    2.604E-11   0.000E+00    0.000E+00
        90.0 0.468  0.183         1.137E-08    2.604E-11   0.000E+00    0.000E+00
       180.0 0.468  0.183         1.137E-08    2.604E-11   0.000E+00    0.000E+00
       270.0 0.468  0.183         1.137E-08    2.604E-11   0.000E+00    0.000E+00
```

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.      6 Spectral Bin No.      1
Basic Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or      3.333 to      3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

Source and background calculations


Observer altitude                           =     100.     km.
Observer elevation angle                    =     -14.0    deg.
Source altitude                             =     1.00     km.
Source elevation angle                      =     9.93     deg.
Observer-Source slant range                 =     478.     km.
Observer-Source grnd. range                 =     464.     km.
Observer-Source earth center angle          =     4.18     deg.
Observer latitude                           =     46.0     deg.
Observer longitude                          =     -98.2    deg.
Terrain altitude                            =     0.487    km.
Background elevation angle                  =     9.90     deg.
Obsv-Background slant range                 =     481.     km.
Obsv-Background grnd. range                 =     467.     km.
Obsv-Background earth center angle          =     4.20     deg.
Tangent altitude                            =     0.487    km

 Azimuth -------------------------Source (w/cm**2/sr)------------------------
  (deg) Transmit. Scintill.           Solr+Lunr    Em.Path    Sc.Path Path StDv


  155.7 7.696E-02 1.011E+00           0.000E+00 1.229E-08 0.000E+00 3.422E-13

 Azimuth -----------------------Background (w/cm**2/sr)-----------------------
  (deg)     Type    Emission Reflection    Em.Path    Sc.Path Bkgd.StDv Path StDv


  155.7 Frst-Frmld 1.274E-12 0.000E+00 1.387E-08 0.000E+00 4.487E-11 1.458E-11

No skyshine
```

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.      6 Spectral Bin No.      1
Source Atmospheric Conditions (Source alt. =      1.00 km)

Freq.range  3000.0 to  3000.0 cm-1 or      3.333 to      3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

Source and background calculations


Azim.  (deg):      155.7

Press.  (mb):      900.0
Pr.alt. (km):       0.99
Temp.    (K):      287.0
RH (wtr) (%):       68.2
RH (ice) (%):       68.2

H2O    (ppmv):   12052.2
CO2    (ppmv):     331.5
O3     (ppmv):     0.032
N2O    (ppmv):     0.318
CO     (ppmv):     0.162
CH4    (ppmv):     1.707
O2     (ppmv):   208496.
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 6 Spectral Bin No. 1
Terrain Material Summary

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Source and background calculations

155.75 deg: Mixed Forest/Farmland Background

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	1.2866E-09	1.2866E-09	-2.800	160.000	1.650
5	FirstYrIce	0.0000	1.2612E-09	1.2612E-09	-2.800	160.000	1.650
8	Wet Snow	0.0008	1.5858E-09	1.5858E-09	-1.800	1000.000	1.650

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.     6 Spectral Bin No.     1
Background Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or     3.333 to     3.333 um
Wavenumber increment =     5.0 cm-1
Equiv.Bandwidth =     5.0 cm-1 (    0.0056 um)  Square response

Source and background calculations

Observer altitude                   =     100.     km.
Observer elevation angle            =    -14.0     deg.
Terrain altitude                    =    0.487     km.
Background elevation angle          =     9.90     deg.
Obsv-Background slant range         =     481.     km.
Obsv-Background grnd. range         =     467.     km.
Obsv-Background earth center angle =      4.20     deg.

Source latitude                     =     46.0     deg.
Source longitude                    =    -98.2     deg.
Tangent altitude                    =    0.487     km.

Foreground altitudes selected

Alt.  Azim Trans. Scint.        Path Radiance Std.Dev.  Solar/Lunar   Skyshine
(km)  (deg)                     -----(w/cm**2/sr)------ ------(w/cm**2)--------

  0.5 155.7 0.043   1.060         1.387E-08   1.458E-11   0.000E+00   0.000E+00
```

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.      7 Spectral Bin No.     1
Basic Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or      3.333 to      3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

At-Source Calculations


   Source altitude               =     1.00     km.
   Terrain altitude              =    0.487     km.


  Azimuth    Solar Irr.  Lunar Irr.
   (deg)     ------ (w/cm**2) -----

      0.000    0.000E+00    0.000E+00
     90.000    0.000E+00    0.000E+00
    180.000    0.000E+00    0.000E+00
    270.000    0.000E+00    0.000E+00

No skyshine
```

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.      7 Spectral Bin No.      1
Source Atmospheric Conditions (Source alt. =     1.00 km)

Freq.range  3000.0 to  3000.0 cm-1 or     3.333 to     3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

At-Source Calculations


Azim.  (deg):       0.0     90.0    180.0    270.0

Press.  (mb):     900.0    900.0    900.0    900.0
Pr.alt. (km):      0.99     0.99     0.99     0.99
Temp.    (K):     287.0    287.0    287.0    287.0
RH (wtr) (%):      68.2     68.2     68.2     68.2
RH (ice) (%):      68.2     68.2     68.2     68.2

H2O    (ppmv):  12052.2  12052.2  12052.2  12052.2
CO2    (ppmv):    331.5    331.5    331.5    331.5
O3     (ppmv):    0.032    0.032    0.032    0.032
N2O    (ppmv):    0.318    0.318    0.318    0.318
CO     (ppmv):    0.162    0.162    0.162    0.162
CH4    (ppmv):    1.707    1.707    1.707    1.707
O2     (ppmv):  208496.  208496.  208496.  208496.
```

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.      8 Spectral Bin No.      1
Basic Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or     3.333 to     3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

Horizontal path

Source altitude                         =     1.00      km.
Observer-Source slant range             =     1.00      km.
Observer-Source ground range            =    1.000      km.
Observer-Source earth center angle =    8.999E-03 deg.

 Azimuth -------------------------Source (w/cm**2/sr)------------------------
  (deg) Transmit. Scintill.           Solr+Lunr   Em.Path    Sc.Path Path StDv


    0.0 7.887E-01 0.000E+00           0.000E+00 9.522E-09 0.000E+00 2.698E-12
   90.0 7.886E-01 0.000E+00           0.000E+00 9.525E-09 0.000E+00 2.700E-12
  180.0 7.886E-01 0.000E+00           0.000E+00 9.527E-09 0.000E+00 2.701E-12
  270.0 7.886E-01 0.000E+00           0.000E+00 9.525E-09 0.000E+00 2.700E-12

No skyshine
```

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.      8 Spectral Bin No.      1
Source Atmospheric Conditions (Source alt. =      1.00 km)

Freq.range  3000.0 to  3000.0 cm-1 or      3.333 to      3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

Horizontal path


Azim.   (deg):       0.0     90.0    180.0    270.0

Press.   (mb):     900.0    900.0    900.0    900.0
Pr.alt.  (km):      0.99     0.99     0.99     0.99
Temp.     (K):     287.0    287.0    287.0    287.0
RH (wtr)  (%):      68.2     68.2     68.2     68.2
RH (ice)  (%):      68.2     68.2     68.2     68.2

H2O     (ppmv):  12049.1  12052.2  12055.2  12052.2
CO2     (ppmv):    331.5    331.5    331.5    331.5
O3      (ppmv):    0.032    0.032    0.032    0.032
N2O     (ppmv):    0.318    0.318    0.318    0.318
CO      (ppmv):    0.162    0.162    0.162    0.162
CH4     (ppmv):    1.707    1.707    1.708    1.707
O2      (ppmv):  208497.  208496.  208496.  208496.
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 9 Spectral Bin No. 1
Basic Radiative Environment

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Earthlimb path

Observer altitude = 400. km.
Tangent height = 350. km.
Observer elevation angle = -7.00 deg.

Azimuth		-----------------------	Background (w/cm**2/sr)	-----------------------			
(deg)	Type	Emission	Reflection	Em.Path	Sc.Path	Bkgd.StDv	Path StDv
0.0	Sky	9.522E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
90.0	Sky	1.179E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
180.0	Sky	8.969E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
270.0	Sky	3.305E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

No skyshine

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 10 Spectral Bin No. 1
Basic Radiative Environment

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Earthlimb path

Observer altitude	=	100.	km.
Tangent height	=	1.00	km.
Observer elevation angle	=	-9.96	deg.

Azimuth (deg)	Type	Emission	Reflection	Em.Path	Sc.Path	Bkgd.StDv	Path StDv
		----------------------	Background	(w/cm**2/sr)	----------------------		
0.0	Sky	7.978E-32	0.000E+00	5.262E-09	0.000E+00	0.000E+00	7.921E-14
90.0	Sky	8.809E-33	0.000E+00	5.130E-09	0.000E+00	0.000E+00	7.833E-14
180.0	Sky	5.945E-32	0.000E+00	4.982E-09	0.000E+00	0.000E+00	7.630E-14
270.0	Sky	2.663E-31	0.000E+00	5.130E-09	0.000E+00	0.000E+00	7.833E-14

No skyshine

```
Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No.    11 Spectral Bin No.      1
Basic Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or      3.333 to      3.333 um
Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 (     0.0056 um)  Square response

Earthlimb path

Observer altitude                         =     400.     km.
Tangent height                            =    -200.     km.
Observer elevation angle                  =    -24.3     deg.

 Azimuth -----------------------Background (w/cm**2/sr)-----------------------
  (deg)     Type     Emission Reflection   Em.Path    Sc.Path Bkgd.StDv Path StDv


    0.0 Forest/Agr 2.166E-12 0.000E+00 1.710E-08 0.000E+00 8.512E-11 2.154E-11
   90.0 Forest/Agr 1.838E-12 0.000E+00 1.708E-08 0.000E+00 7.224E-11 2.156E-11
  180.0 Forest/Agr 1.522E-12 0.000E+00 1.706E-08 0.000E+00 5.980E-11 2.158E-11
  270.0 Forest/Agr 1.838E-12 0.000E+00 1.708E-08 0.000E+00 7.224E-11 2.156E-11

No skyshine
```

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 11 Spectral Bin No. 1
Terrain Material Summary

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Earthlimb path

0.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.8487E-09	2.8487E-09	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.8076E-09	2.8076E-09	-1.800	160.000	1.650
8	Wet Snow	0.0006	3.3572E-09	3.3572E-09	-1.900	800.000	1.650

90.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4348E-09	2.4348E-09	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.3819E-09	2.3819E-09	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.8481E-09	2.8481E-09	-1.900	800.000	1.650

180.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.0226E-09	2.0226E-09	-1.800	160.000	1.650
5	FirstYrIce	0.0000	1.9711E-09	1.9711E-09	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.3570E-09	2.3570E-09	-1.900	800.000	1.650

270.00 deg: Forested Terrain/Agricultural Terrain (Fulda, Germany)

--- Material --- No.	Name	Fraction	---- Mean Radiance ---- (w/cm**2/sr) Sun	Shade	Standard Deviation	Correl. Length (m)	PSD Slope
1	Fr. Water	0.0000	2.4348E-09	2.4348E-09	-1.800	160.000	1.650
5	FirstYrIce	0.0000	2.3819E-09	2.3819E-09	-1.800	160.000	1.650
8	Wet Snow	0.0006	2.8481E-09	2.8481E-09	-1.900	800.000	1.650

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 11 Spectral Bin No. 1
Background Radiative Environment

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Earthlimb path

Observer altitude = 400. km.
Tangent altitude = -200. km.
Observer elevation angle = -24.3 deg.

Foreground altitudes selected

Alt. (km)	Azim (deg)	Trans.	Scint.	Path Radiance -----(w/cm**2/sr)------	Std.Dev.	Solar/Lunar ------(w/cm**2)--------	Skyshine
0.5	0.0	0.060	1.300	1.710E-08	2.154E-11	0.000E+00	0.000E+00
	90.0	0.060	1.300	1.708E-08	2.156E-11	0.000E+00	0.000E+00
	180.0	0.060	1.300	1.706E-08	2.158E-11	0.000E+00	0.000E+00
	270.0	0.060	1.300	1.708E-08	2.156E-11	0.000E+00	0.000E+00

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

Geometry No. 12 Spectral Bin No. 1
Basic Radiative Environment

Freq.range 3000.0 to 3000.0 cm-1 or 3.333 to 3.333 um
Wavenumber increment = 5.0 cm-1
Equiv.Bandwidth = 5.0 cm-1 (0.0056 um) Square response

Earthlimb path

Observer altitude = 400. km.
Tangent height = 0.378 km.
Observer elevation angle = -19.8 deg.

Azimuth (deg)	Type	Background (w/cm**2/sr) Emission	Reflection	Em.Path	Sc.Path	Bkgd.StDv	Path StDv
0.0	Sky	0.000E+00	0.000E+00	6.349E-09	0.000E+00	0.000E+00	1.044E-13
90.0	Sky	1.191E-43	0.000E+00	5.963E-09	0.000E+00	0.000E+00	9.165E-14
180.0	Sky	1.467E-33	0.000E+00	4.269E-09	0.000E+00	0.000E+00	6.228E-14
270.0	Sky	3.209E-42	0.000E+00	5.963E-09	0.000E+00	0.000E+00	9.165E-14

No skyshine

Sample Input File
MOSART Radiative Environment Summary (Ver. 1.40) Tue May 16 12:10:49 1995

```
Geometry No.    12 Spectral Bin No.     1
Background Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or     3.333 to     3.333 um
Wavenumber increment =     5.0 cm-1
Equiv.Bandwidth =     5.0 cm-1 (    0.0056 um)  Square response

Earthlimb path

Observer altitude                    =     400.     km.
Tangent altitude                     =    0.378     km.
Observer elevation angle             =    -19.8     deg.

Foreground altitudes selected


Alt.  Azim Trans. Scint.        Path Radiance Std.Dev.  Solar/Lunar   Skyshine
(km)  (deg)                     -----(w/cm**2/sr)------ ------(w/cm**2)--------

  0.5    0.0 0.000   1.523        6.349E-09   1.044E-13   0.000E+00   0.000E+00
        90.0 0.000   1.523        5.963E-09   9.165E-14   0.000E+00   0.000E+00
       180.0 0.000   1.523        4.269E-09   6.228E-14   0.000E+00   0.000E+00
       270.0 0.000   1.523        5.963E-09   9.165E-14   0.000E+00   0.000E+00
```

APPENDIX B: SAMPLE BBTEMP OUTPUT

```
Check Input File
MOSART Radiative Environment Summary (Ver. 1.25) Sun Jul 11 21:17:21 1994

Latitude  =     50.000 deg North
Longitude =    100.000 deg West
Date      = 21 Jun 1991
Time      = 12:00:00.0 (LST)

Model No.      1:  Subtropical (30 N. Lat.) July Atmosphere
                     (Exospheric temperature = 1000.0 K)
Model No.      2:  Midlatitude (45 N. Lat.) Summer Atmosphere
                     (Exospheric temperature = 1000.0 K)
Model No.      3:  Subarctic (60 N. Lat.) Summer Atmosphere
                     (Exospheric temperature = 1000.0 K)

Rural Boundary Layer Aerosol Model (Visibility = 10.0 km)
Background Stratospheric Aerosol Model (Temp.Dep.)
Shettle/Fenn Background Summer Aerosol Profile
Normal Upper Atmosphere Aerosol Profile
Standard boundary layer vertical structure

Terrain type - Global Backgrounds
  Terrain altitude        =       0.243 km
  Air temperature         =     302.40 K (No. 1)
                                293.11 K (No. 2)
                                285.86 K (No. 3)
  Current wind speed      =       4.10 m/sec (No. 1)
                                  4.10 m/sec (No. 2)
                                  6.69 m/sec (No. 3)
  Surface turbulence, Cn2 =  1.000E-14 m**-2/3
  Av. hi alt. wind speed  =      27.00 m/sec
```

Check Input File
MOSART Radiative Environment Summary (Ver. 1.00) Sun Jul 11 21:17:21 1993

Model Atmosphere No. 1:	Total	Low Etage	Middle Etage	High Etage
Cloud cover :	24.94 %	5.65 %	14.51 %	4.78 %
Cloud base altitude:		1.23 km	3.24 km	8.91 km
Cloud top altitude :		1.73 km	3.74 km	9.41 km

Model Atmosphere No. 2:	Total	Low Etage	Middle Etage	High Etage
Cloud cover :	41.60 %	4.00 %	24.40 %	13.40 %
Cloud base altitude:		1.50 km	3.74 km	8.33 km
Cloud top altitude :		2.00 km	4.24 km	8.83 km

Model Atmosphere No. 3:	Total	Low Etage	Middle Etage	High Etage
Cloud cover :	53.40 %	10.00 %	32.40 %	10.80 %
Cloud base altitude:		1.50 km	3.60 km	6.40 km
Cloud top altitude :		2.00 km	4.10 km	6.90 km

No clouds, fog, or rain models

Source-based coordinate reference frame

No solar calculations

No lunar calculations

Geometry Conditions (1 positions)

No		Observer Altitude (km)	Src/Tang Altitude (km)	Slant Range (km)	Earth Center Angle (deg)	Obs. Look Angle (deg)	Src. Look Angle (deg)
1	Ce	100.00	1.00	99.01	0.00	-90.00	90.00

Observer aperture - 1.000 meters
Observer field of view - 1.000 mrad
Background material temperatures set to local air temperature
1 cm**-1 band parameters used
Single scattering calculations only

File root name - check
Input file - .in
ASCII output file - .out
Source data file - .atm

```
Check Input File
MOSART Radiative Environment Summary (Ver. 1.25) Sun Jul 11 21:17:21 1994

Geometry No.     1 - Blackbody Temperature Radiative Environment

Freq.range  3000.0 to  3000.0 cm-1 or   3.333 to   3.333 um
Spectral resolution =    20.0 cm-1 - Wavenumber increment =     5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 ( 0.0056 um)  Square spectral filter

Source and background calculations


Observer altitude                            =     100.      km.
Observer elevation angle                     =    -90.0      deg.
Source altitude                              =     1.00      km.
Source elevation angle                       =     90.0      deg.
Observer-Source slant range                  =     99.0      km.
Observer-Source grnd. range                  =    0.000E+00 km.
Observer-Source earth center angle           =    0.000E+00 deg.
Terrain altitude                             =    0.243      km.
Background elevation angle                   =     90.0      deg.
Obsv-Background slant range                  =     99.8      km.
Obsv-Background grnd. range                  =    0.000E+00 km.
Obsv-Background earth center angle           =    0.000E+00 deg.
Tangent altitude                             =    0.243      km

Azimuth =     0.00 deg.

Background Blackbody Temperature                  =      282.51 K
Source Path Thermal Blackbody Temperature         =      259.18 K
Source Path Scattered Blackbody Temperature       =        0.00 K
Source Path Radiance St.Dev.                      =        0.01 K
Source Transmittance                              = 5.1515E-01
Source Scintillation                              = 4.8980E-05
Source Forward Scattered Transmittance            = 5.3351E-01
Background Transmittance                          = 4.2577E-01
Background Scintillation                          = 4.8980E-05
Background Forward Scattered Transmittance        = 4.6166E-01
Background Emitted Blackbody Temperature          =      274.41 K
Background Reflected Blackbody Temperature        =        0.00 K
Background Path Thermal Blackbody Temperature     =      264.94 K
Background Path Scattered Blackbody Temperature   =        0.00 K
Background St.Dev. Blackbody Temperature          =        1.35 K
Background Path St.Dev. Blackbody Temperature     =        0.57 K
```

Azimuth = 90.00 deg.

Background Blackbody Temperature	=	282.51 K
Source Path Thermal Blackbody Temperature	=	259.18 K
Source Path Scattered Blackbody Temperature	=	0.00 K
Source Path Radiance St.Dev.	=	0.01 K
Source Transmittance	=	5.1515E-01
Source Scintillation	=	4.8980E-05
Source Forward Scattered Transmittance	=	5.3351E-01
Background Transmittance	=	4.2577E-01
Background Scintillation	=	4.8980E-05
Background Forward Scattered Transmittance	=	4.6166E-01
Background Emitted Blackbody Temperature	=	274.41 K
Background Reflected Blackbody Temperature	=	0.00 K
Background Path Thermal Blackbody Temperature	=	264.94 K
Background Path Scattered Blackbody Temperature	=	0.00 K
Background St.Dev. Blackbody Temperature	=	1.35 K
Background Path St.Dev. Blackbody Temperature	=	0.57 K

Azimuth = 180.00 deg.

Background Blackbody Temperature	=	282.51 K
Source Path Thermal Blackbody Temperature	=	259.18 K
Source Path Scattered Blackbody Temperature	=	0.00 K
Source Path Radiance St.Dev.	=	0.01 K
Source Transmittance	=	5.1515E-01
Source Scintillation	=	4.8980E-05
Source Forward Scattered Transmittance	=	5.3351E-01
Background Transmittance	=	4.2577E-01
Background Scintillation	=	4.8980E-05
Background Forward Scattered Transmittance	=	4.6166E-01
Background Emitted Blackbody Temperature	=	274.41 K
Background Reflected Blackbody Temperature	=	0.00 K
Background Path Thermal Blackbody Temperature	=	264.94 K
Background Path Scattered Blackbody Temperature	=	0.00 K
Background St.Dev. Blackbody Temperature	=	1.35 K
Background Path St.Dev. Blackbody Temperature	=	0.57 K

Azimuth = 270.00 deg.

Background Blackbody Temperature	=	282.51 K
Source Path Thermal Blackbody Temperature	=	259.18 K
Source Path Scattered Blackbody Temperature	=	0.00 K
Source Path Radiance St.Dev.	=	0.01 K
Source Transmittance	=	5.1515E-01
Source Scintillation	=	4.8980E-05
Source Forward Scattered Transmittance	=	5.3351E-01
Background Transmittance	=	4.2577E-01
Background Scintillation	=	4.8980E-05
Background Forward Scattered Transmittance	=	4.6166E-01
Background Emitted Blackbody Temperature	=	274.41 K
Background Reflected Blackbody Temperature	=	0.00 K
Background Path Thermal Blackbody Temperature	=	264.94 K
Background Path Scattered Blackbody Temperature	=	0.00 K
Background St.Dev. Blackbody Temperature	=	1.35 K
Background Path St.Dev. Blackbody Temperature	=	0.57 K

```
Check Input File
MOSART Radiative Environment Summary (Ver. 1.25) Sun Jul 11 21:17:21 1994

Geometry No.      1 - Blackbody Temperature Radiative Environment

Freq.range  5000.0 to  5000.0 cm-1 or   2.000 to   2.000 um
Spectral resolution =     20.0 cm-1 - Wavenumber increment =      5.0 cm-1
Equiv.Bandwidth =      5.0 cm-1 ( 0.0020 um)  Square spectral filter

Source and background calculations


Observer altitude                          =     100.      km.
Observer elevation angle                   =     -90.0     deg.
Source altitude                            =     1.00      km.
Source elevation angle                     =     90.0      deg.
Observer-Source slant range                =     99.0      km.
Observer-Source grnd. range                =    0.000E+00  km.
Observer-Source earth center angle         =    0.000E+00  deg.
Terrain altitude                           =    0.243      km.
Background elevation angle                 =     90.0      deg.
Obsv-Background slant range                =     99.8      km.
Obsv-Background grnd. range                =    0.000E+00  km.
Obsv-Background earth center angle         =    0.000E+00  deg.
Tangent altitude                           =    0.243      km

Azimuth =     0.00 deg.

Background Blackbody Temperature                     =      284.30 K
Source Path Thermal Blackbody Temperature            =      262.16 K
Source Path Scattered Blackbody Temperature          =        0.00 K
Source Path Radiance St.Dev.                         =        0.01 K
Source Transmittance                                 = 6.4960E-01
Source Scintillation                                 = 4.8980E-05
Source Forward Scattered Transmittance               = 6.9299E-01
Background Transmittance                             = 5.7912E-01
Background Scintillation                             = 4.8980E-05
Background Forward Scattered Transmittance           = 6.6125E-01
Background Emitted Blackbody Temperature             =      281.92 K
Background Reflected Blackbody Temperature           =        0.00 K
Background Path Thermal Blackbody Temperature        =      266.92 K
Background Path Scattered Blackbody Temperature      =        0.00 K
Background St.Dev. Blackbody Temperature             =        1.39 K
Background Path St.Dev. Blackbody Temperature        =        0.72 K
```

Azimuth = 90.00 deg.

```
Background Blackbody Temperature                  =     284.30 K
Source Path Thermal Blackbody Temperature         =     262.16 K
Source Path Scattered Blackbody Temperature       =       0.00 K
Source Path Radiance St.Dev.                      =       0.01 K
Source Transmittance                              = 6.4960E-01
Source Scintillation                              = 4.8980E-05
Source Forward Scattered Transmittance            = 6.9299E-01
Background Transmittance                          = 5.7912E-01
Background Scintillation                          = 4.8980E-05
Background Forward Scattered Transmittance        = 6.6125E-01
Background Emitted Blackbody Temperature          =     281.92 K
Background Reflected Blackbody Temperature        =       0.00 K
Background Path Thermal Blackbody Temperature     =     266.92 K
Background Path Scattered Blackbody Temperature   =       0.00 K
Background St.Dev. Blackbody Temperature          =       1.39 K
Background Path St.Dev. Blackbody Temperature     =       0.72 K
```

Azimuth = 180.00 deg.

```
Background Blackbody Temperature                  =     284.30 K
Source Path Thermal Blackbody Temperature         =     262.16 K
Source Path Scattered Blackbody Temperature       =       0.00 K
Source Path Radiance St.Dev.                      =       0.01 K
Source Transmittance                              = 6.4960E-01
Source Scintillation                              = 4.8980E-05
Source Forward Scattered Transmittance            = 6.9299E-01
Background Transmittance                          = 5.7912E-01
Background Scintillation                          = 4.8980E-05
Background Forward Scattered Transmittance        = 6.6125E-01
Background Emitted Blackbody Temperature          =     281.92 K
Background Reflected Blackbody Temperature        =       0.00 K
Background Path Thermal Blackbody Temperature     =     266.92 K
Background Path Scattered Blackbody Temperature   =       0.00 K
Background St.Dev. Blackbody Temperature          =       1.39 K
Background Path St.Dev. Blackbody Temperature     =       0.72 K
```

Azimuth = 270.00 deg.

```
Background Blackbody Temperature                  =     284.30 K
Source Path Thermal Blackbody Temperature         =     262.16 K
Source Path Scattered Blackbody Temperature       =       0.00 K
Source Path Radiance St.Dev.                      =       0.01 K
Source Transmittance                              = 6.4960E-01
Source Scintillation                              = 4.8980E-05
Source Forward Scattered Transmittance            = 6.9299E-01
Background Transmittance                          = 5.7912E-01
Background Scintillation                          = 4.8980E-05
Background Forward Scattered Transmittance        = 6.6125E-01
Background Emitted Blackbody Temperature          =     281.92 K
Background Reflected Blackbody Temperature        =       0.00 K
Background Path Thermal Blackbody Temperature     =     266.92 K
Background Path Scattered Blackbody Temperature   =       0.00 K
Background St.Dev. Blackbody Temperature          =       1.39 K
Background Path St.Dev. Blackbody Temperature     =       0.72 K
```

APPENDIX C: SAMPLE VISUAL OUTPUT FILE

```
Check Input File
MOSART Radiative Environment Summary (Ver. 1.25) Wed Jul 28 07:31:49 1994

Latitude  =     50.000 deg North
Longitude =    100.000 deg West
Date      = 21 Jun 1991
Time      = 12:00:00.0 (LST)

Model No.     1:  Subtropical (30 N. Lat.) July Atmosphere
                    (Exospheric temperature = 1000.0 K)
Model No.     2:  Midlatitude (45 N. Lat.) Summer Atmosphere
                    (Exospheric temperature = 1000.0 K)
Model No.     3:  Subarctic (60 N. Lat.) Summer Atmosphere
                    (Exospheric temperature = 1000.0 K)

Rural Boundary Layer Aerosol Model (Visibility = 10.0 km)
Background Stratospheric Aerosol Model (Temp.Dep.)
Shettle/Fenn Background Summer Aerosol Profile
Normal Upper Atmosphere Aerosol Profile
Standard boundary layer vertical structure

Terrain type - Global Backgrounds
  Terrain altitude          =       0.243 km
  Air temperature           =     302.40 K (No. 1)
                                  293.11 K (No. 2)
                                  285.86 K (No. 3)
  Current wind speed        =       4.10 m/sec (No. 1)
                                    4.10 m/sec (No. 2)
                                    6.69 m/sec (No. 3)
  Surface turbulence, Cn2 =  1.000E-14 m**-2/3
  Av. hi alt. wind speed  =      27.00 m/sec
```

```
Check Input File
MOSART Radiative Environment Summary (Ver. 1.25) Wed Jul 28 07:31:49 1994

Model Atmosphere No.       1:    Total       Low Etage Middle Etage    High Etage
  Cloud cover          :        24.94 %       5.65 %       14.51 %        4.78 %
  Cloud base altitude:                        1.23 km       3.24 km       8.91 km
  Cloud top altitude :                        1.73 km       3.74 km       9.41 km

Model Atmosphere No.       2:    Total       Low Etage Middle Etage    High Etage
  Cloud cover          :        41.60 %       4.00 %       24.40 %       13.40 %
  Cloud base altitude:                        1.50 km       3.74 km       8.33 km
  Cloud top altitude :                        2.00 km       4.24 km       8.83 km

Model Atmosphere No.       3:    Total       Low Etage Middle Etage    High Etage
  Cloud cover          :        53.40 %      10.00 %       32.40 %       10.80 %
  Cloud base altitude:                        1.50 km       3.60 km       6.40 km
  Cloud top altitude :                        2.00 km       4.10 km       6.90 km

No clouds, fog, or rain models

Source-based coordinate reference frame

Fully correlated, complex geometry solar calculations
  Solar elevation =       63.10 deg at Source
  Solar azimuth   =      189.24 deg at Source
  Solar latitude  =       23.45 deg
  Solar longitude =     -104.52 deg
  Solar distance  =      1.0163
  Solar constant  =     1329.54 w/m**2

Fully correlated, complex geometry lunar calculations
  Lunar elevation =      -25.42 deg at Source
  Lunar azimuth   =       78.98 deg at Source
  Lunar latitude  =      -11.95 deg
  Lunar longitude =     -345.83 deg
  Lunar distance  =      1.0358
  Lunar phase     =      121.75 deg

Ephemeris calculations


Geometry Conditions (     1 positions)

         Observer     Src/Tang        Slant   Earth Center   Obs. Look     Src. Look
No       Altitude     Altitude        Range      Angle         Angle         Angle
           (km)         (km)           (km)       (deg)         (deg)         (deg)

 1  Ce    100.00         1.00         99.01        0.00        -90.00         90.00

Observer aperture       -       1.000 meters
Observer field of view -        1.000 mrad
Background material temperatures set to local air temperature
1 cm**-1 band parameters used
Multiple scattering calculations

File root name   - vis
     Input file              - .in
     ASCII output file       - .out
     Source data file        - .atm
```

```
Check Input File
MOSART Radiative Environment Summary (Ver. 1.25) Wed Jul 28 07:31:49 1994

Geometry No.      1 - Visible Radiative Environment

Freq.range 12776.0 to 27205.0 cm-1 or    0.368 to    0.783 um
Spectral resolution =    0.005 um - Wavelength increment =      0.0 um
Equiv.Bandwidth =  3413.3 cm-1 ( 0.1053 um)  Human visual response

Source and background calculations


Observer altitude                          =     100.      km.
Observer elevation angle                   =    -90.0      deg.
Source altitude                            =     1.00      km.
Source elevation angle                     =     90.0      deg.
Observer-Source slant range                =     99.0      km.
Observer-Source grnd. range                =    0.000E+00  km.
Observer-Source earth center angle         =    0.000E+00  deg.
Terrain altitude                           =    0.243      km.
Background elevation angle                 =     90.0      deg.
Obsv-Background slant range                =     99.8      km.
Obsv-Background grnd. range                =    0.000E+00  km.
Obsv-Background earth center angle         =    0.000E+00  deg.
Tangent altitude                           =    0.243      km

Azimuth =     0.00 deg.

                                                                  Color content
                                                                       X:Y

Background Luminance                          = 3.0616E-01 1/cm**2/sr  30.5:31.1
Source Path Thermal Radiance                  = 2.2257E-13 1/cm**2/sr  67.2:32.5
Source Path Scattered Radiance                = 1.3712E-01 1/cm**2/sr  26.1:26.6
Source Path Radiance St.Dev.                  = 5.8645E-03 1/cm**2/sr  22.6:21.5
Source Transmittance                          = 5.8721E-01
Source Scintillation                          = 4.8980E-05
Source Forward Scattered Transmittance        = 1.4178E+00
Background Transmittance                      = 4.4482E-01
Background Scintillation                      = 4.8980E-05
Background Forward Scattered Transmittance    = 1.4178E+00
Source Solar Irradiance                       = 4.1889E+00 1/cm**2/sr  36.8:37.0
Source Lunar Irradiance                       = 0.0000E+00 1/cm**2/sr   0.0: 0.0
Background Emitted Radiance                   = 3.6883E-27 1/cm**2/sr  73.1:26.9
Background Reflected Luminance                = 1.3948E-01 1/cm**2/sr  36.7:37.2
Background Path Thermal Luminance             = 7.5089E-13 1/cm**2/sr  67.3:32.4
Background Path Scattered Luminance           = 1.6668E-01 1/cm**2/sr  26.7:27.4
Background Standard Deviation                 = 8.2076E-02 1/cm**2/sr  35.9:35.8
Background Path Luminance St.Dev.             = 5.1522E-02 1/cm**2/sr  29.1:29.7
```

APPENDIX D: TABULAR CONTENTS

The contents of the tables generated by ASCBIN (see Section 6.6) are presented in Tables D-1 through D-11.

Table D-1. Summary of Basic Observer/Source Data Contents.

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Observer-Source Transmittance	-
4	Observer-Source Scintillation	-
5	Observer-Source In-Scattered Transmittance	-
6	Observer-Source Emitted Path Radiance	$W/cm^2/sr/cm^{-1}$
7	Observer-Source Emitted Path Radiance	$W/cm^2/sr/\mu m$
8	Observer-Source Integrated Emitted Path Radiance	$W/cm^2/sr$

Table D-2. Summary of Azimuthal Observer/Source Data (Type I).

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Observer-Source Path Clutter	$W/cm^2/sr/cm^{-1}$
4	Observer-Source Path Clutter	$W/cm^2/sr/\mu m$
5	Observer-Source Integrated Path Clutter	$W/cm^2/sr$

Table D-3. Summary of Azimuthal Observer/Source Data (Type II).

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Source Solar Irradiance	$W/cm^2/cm^{-1}$
4	Source Solar Irradiance	$W/cm^2/\mu m$
5	Source Integrated Solar Irradiance	W/cm^2
6	Observer-Source Scattered Path Radiance	$W/cm^2/sr/cm^{-1}$
7	Observer-Source Scattered Path Radiance	$W/cm^2/sr/\mu m$
8	Observer-Source Integrated Scattered Path Radiance	$W/cm^2/sr$

Table D-4. Summary of Basic Background Data.

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Observer-Source Transmittance	-
4	Observer-Source Scintillation	-
5	Observer-Source In-Scattered Transmittance	-

Table D-5. Summary of Azimuthal Basic Background Data (Type I).

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Observer-Background Emitted Path Radiance	$W/cm^2/sr/cm^{-1}$
4	Observer-Background Emitted Path Radiance	$W/cm^2/sr/\mu m$
5	Observer-Background Integrated Emitted Path Radiance	$W/cm^2/sr$
6	Observer-Background Path Clutter	$W/cm^2/sr/cm^{-1}$
7	Observer-Background Path Clutter	$W/cm^2/sr/\mu m$
8	Observer-Background Integrated Path Clutter	$W/cm^2/sr$

Table D-6. Summary of Azimuthal Background Data (Type II).

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Background Emitted Radiance	$W/cm^2/sr/cm^{-1}$
4	Background Emitted Radiance	$W/cm^2/sr/\mu m$
5	Background Integrated Emitted Radiance	$W/cm^2/sr$
6	Background Reflected Radiance	$W/cm^2/sr/cm^{-1}$
7	Background Reflected Radiance	$W/cm^2/sr/\mu m$
8	Background Integrated Reflected Radiance	$W/cm^2/sr$

Table D-7. Summary of Azimuthal Background Data (Type III).

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Observer-Background Scattered Path Radiance	$W/cm^2/sr/cm^{-1}$
4	Observer-Background Scattered Path Radiance	$W/cm^2/sr/\mu m$
5	Observer-Background Integrated Scattered Path Radiance	$W/cm^2/sr$
6	Background Standard Deviation	$W/cm^2/sr/cm^{-1}$
7	Background Standard Deviation	$W/cm^2/sr/\mu m$
8	Background Integrated Standard Deviation	$W/cm^2/sr$

Table D-8. Summary of Basic Background/Altitude Data (Type I).

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Observer-Altitude Transmittance	-
4	Observer-Altitude Scintillation	-
5	Observer-Altitude In-Scattered Transmittance	-
6	Observer-Altitude Emitted Path Radiance	$W/cm^2/sr/cm^{-1}$
7	Observer-Altitude Emitted Path Radiance	$W/cm^2/sr/\mu m$
8	Observer-Altitude Integrated Emitted Path Radiance	$W/cm^2/sr$

Table D-9. Summary of Basic Background/Altitude Data (Type II).

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Observer-Altitude Upper Hemisphere Emitted Skyshine	$W/cm^2/sr/cm^{-1}$
4	Observer-Altitude Upper Hemisphere Emitted Skyshine	$W/cm^2/sr/\mu m$
5	Observer-Altitude Integrated Upper Hemisphere Emitted Skyshine	$W/cm^2/sr$
6	Observer-Altitude Upper Hemisphere Scattered Skyshine	$W/cm^2/sr/cm^{-1}$
7	Observer-Altitude Upper Hemisphere Scattered Skyshine	$W/cm^2/sr/\mu m$
8	Observer-Altitude Integrated Upper Hemisphere Scattered Skyshine	$W/cm^2/sr$

Table D-10. Summary of Azimuthal Background/Altitude Solar Data.

Column	Variable	Units
1	Wavenumber	cm^{-1}
2	Wavelength	μm
3	Observer-Altitude Solar Irradiance	-
4	Observer-Altitude Solar Irradiance	-
5	Observer-Altitude Integrated Solar Irradiance	-
6	Observer-Altitude Path Scattered Radiance	$W/cm^2/sr/cm^{-1}$
7	Observer-Altitude Path Scattered Radiance	$W/cm^2/sr/\mu m$
8	Observer-Altitude Integrated Path Scattered Radiance	$W/cm^2/sr$

Table D-11. Summary of Heat Transfer Data Contents.

Column	Variable	Units
1	Local Standard Time	decimal hours
2	Solar Elevation Angle	degrees
3	Local Air Temperature	K
4	SW Direct Beam Irradiance	W/m^2
5	SW Upward Diffuse Irradiance	W/m^2
6	SW Downward Diffuse Irradiance	W/m^2
7	LW Upward Diffuse Irradiance	W/m^2
8	LW Downward Diffuse Irradiance	W/m^2

For the heat transfer data listed in Table D-11, the user either selects the altitude desired or returns to the main menu. The table, generated from the ".htr" file, is a temporal one, rather than a spectral one. The user can cycle over altitudes as desired.

APPENDIX E: INPUT FILE REFERENCES

	Section
Moderate Spectral Atmospheric Radiance and Transmittance (MOSART) (Ver. 1.00)	4.1.1
User-specified Parameters ------------------------ Header .... Sample Printout Switch (S/M/L) .... Short Temperature Calculations (Y/N) .... No Multiple Scattering (Y/N) .... No Solar/Lunar Ephemeris (Y/S/L/N) .... No	4.1.2
Position Parameters ----------------------------- Coordinate Reference (Obsvr/Source) ... Source Latitude (deg) (+ North, - South) ..... 45. Longitude (deg) (+ East, - West) ...... -100. Day of the month (integer) .... 25 Month of the year (integer) .... June Year (integer) .... 1989 Time of day (24-hr HH.MMSS) .... 12.0000 Time index (LST/GMT) .... LST	4.1.3
Geometry Parameters ----------------------------- Observer Azimuths (deg) (<=8) .... 90.0 Azimuth Reference (Relative/True) ..... Relative No. Index Obs. Alt. Sr/Tn.Alt. Sl.Rng. Earth Ang. Obs.Angle Src. Angle Length (km) (km) (km) (deg) (deg.) (deg.) Switch 1 C 0.0 11.0 **** 1.0 **** **** 1 End of Geometry Data/	4.1.4
Spectral Parameters ----------------------------- Spectral Calculations (MO/LO/MM) ...... MO Wavenumber or Wavelength (WN/WL/FR) ... WN Initial wavenumber (cm**-1/um/GHz) .. 800. Final wavenumber (cm**-1/um/GHz) .... 1180. Calculation Width (cm**-1/um/GHz) ... 10.	4.1.5
User-defined File Names ------------------------- User-defined Atmosphere File Name .....None User-defined Background File Name .....None User-defined Hydrometeors File Name ...None User-defined Aerosols File Name ....None Filter Response File Name ....None	4.2.1
File Retention Specifications -------------------- Retain Atmospheric Binary File (Y/N) ..No Retain Background Binary File (Y/N) ...No Retain Plume Binary File (Y/N) ....No Retain Multiple Scattering File (Y/N) .No Retain Heat Transfer File (Y/N) ....No Retain Transmittance File (Y/N) ....No Retain TAPE7 (LOWTRAN) File (Y/N) .....No Retain TAPE8 (LOWTRAN) File (Y/N) .....No Retain DIS In-Band File (Y/N) ....No	4.2.2

	Section
Atmosphere Parameters ---------------------------	4.2.3
Model Atmosphere Latitude (0 - 10) .... Midlatitu	4.2.3.1
Season (Latitude dependent) .... Summer Pressure Profile (0 - 24) .... Temperature Profile (0 - 24) .... Molecular Conc. Profile (0 - 24)	4.2.3.2
Boundary Layer Aerosol Model (0 - 12) . Rural Air Mass Character Index (0 - 10) ... Elapsed Time (days) since land ...... Radon 222 Concentration (pCi/m**3) ..	4.2.3.4
Stratospheric Aerosol Model (0 - 5) ...Background	4.2.3.5
Tropo/Stratosph. Haze Profile (0 - 5) .Background	4.2.3.6
Mesospheric Haze Profile (0 - 2) ......Normal	4.2.3.7
Air Temperature (K) 0.0	4.2.3.8
Surface Cn**2 (m**-2/3) 1.4E-14	4.2.3.9
24-hour Mean Wind Speed (m/sec) ..... Current Wind Speed (m/sec) .... Av. High Altitude Wind Speed (m/sec) ..	4.2.3.10
Vertical Structure Algorithm (Y/N) ....None Inversion Layer Altitude (km)	4.2.3.11
Meteorological Range (km) 23.0	4.2.3.12
Solar and Lunar Parameters ---------------------- Geometry Specification (EP/EA/ZA/LL)...EP Type of Solar Calculations (S/C/N) ....Complex Solar Elev./Zen./Latitude (deg) ..... Solar Azimuth/Longitude (deg) .... Relative Solar Distance .... Type of Lunar Calculations (S/C/N) ....None Lunar Elev./Zen./Latitude (deg) ..... Lunar Azimuth/Longitude (deg) .... Relative Lunar Distance .... Lunar Phase (deg)	4.2.4
Hydrometeor Specifications ---------------------- Cloud/Rain/Fog Model Desired (Y/N) ....No Cloud/Rain/Fog Index (1 - 21) .... Snow Crystal Type (1-6) .... Cirrus Cloud Type (N/ST/SV/HL) ....None Cirrus Cloud Base Altitude (km) ..... Cirrus Cloud Thickness (km) .... Cirrus Extinct.(km**-1 at 0.55 um) .. Cirrus Equiv. LWC (gm/m**3)	4.2.5
Terrain Specifications -------------------------- Terrain Index (0 - 36) .... 3 Terrain Altitude (km) .... 0.0 Initial Background Altitude (km) ...... 0.0 Final Background Altitude (km) .... 0.0 Fore/Background Altitudes (F/B) ....Foreground Cloud Cover (percent) (l/m/h) .... 0. 0. 0. Cloud Base Altitude (km) (l/m/h) ...... 1. 3. 5. Cloud Top Altitude (km) (l/m/h) .... 2. 4. 6.	4.2.6

	Section

Observer Parameters ------------------------------ **4.2.7**

Observer aperture diameter (m) .... 1.
Observer field-of-view (mrad) .... 1.

Extra Altitude Specifications -------------------- **4.2.8**

Extra Altitudes (km) (<=100) ....

Source Earth/skyshine Specifications ------------------------ **4.2.9**

Azimuth Grid Index (0 - 3) ....
Elevation Grid Index (0 - 14) ....
User-defined Grid (Y/N) .... No
Azimuth grid (deg) (<=4) ....
Elevation grid (deg) (<=32) ....

Antecedent Specifications ------------------------ **4.3.1**

Hour (LST)	Srfc. Temp. (K)	Rel. Hum. %	Wind Speed (m/s)	Srfc. Press. (mb)	Clouds Low %	Low Base	Low Top	Mid %	Mid Base	Mid Top	High %	High Base	High Top
0.0	260.	35.	4.10	1012.	30.0	3.2	3.4	20.0	4.5	4.7	10.0	5.8	6.0
6.0	259.	35.	4.10	1012.	30.0	3.2	3.4	20.0	4.5	4.7	10.0	5.8	6.0
12.0	275.	35.	4.10	1012.	30.0	3.2	3.4	20.0	4.5	4.7	10.0	5.8	6.0
18.0	272.	35.	4.10	1012.	30.0	3.2	3.4	20.0	4.5	4.7	10.0	5.8	6.0
24.0	260.	35.	4.10	1012.	30.0	3.2	3.4	20.0	4.5	4.7	10.0	5.8	6.0

End of Antecedent Data/

User-defined Atmospheric Parameters -------------- **4.3.2**

Radius of the earth (km) ....
Atmospheric Header .... Midlatitude Summer User-defined
Input for Line 2 (Y/N) .... Y
Input for Line 3 (Y/N) .... Y
Input for Line 4 (Y/N) .... N
Input for Line 5 (Y/N) .... N
Input for Line 6 (Y/N) .... Y
Complete Profile with Model (Y/N) .... Y

.

Profiles:

No.	Alt. (km)						Switches
		Pressure	Temperature	H2O	CO2	O3	
		N2O	CO	CH4	O2	NO	
		SO2	NO2	NH3	HNO3	N2	
		CFC-11	CFC-12	CFC-13	CFC-14	CFC-22	
		CFC-113	CFC-114	CFC-115	Unknown	Unknown	
		Unknown	Unknown	Aersol	Haze (km-1)	Cn2	
		---------- units depend on switch -------------------					
1	Surface	1013.25	288.15	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0	0.00	0.00	0 0 0 0 0
2	1.500	982.00	276.01	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0	0.00	0.00	0 0 0 0 0
3	2.500	952.00	268.00	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0.00	0.00	0.00	0 0 0 0 0
		0.00	0.00	0	0.00	0.00	0 0 0 0 0

End of Profile Data/

			Section
Terrain Matl. Temperatures (Sun/Shade) (K) -----------------			4.3.3
Fresh Water	0.00	0.00	
Sea Water	0.00	0.00	
MODTRAN Ocean	0.00	0.00	
GENESSIS Water Ocean	0.00	0.00	
First Year Ice	0.00	0.00	
Multi-Year Ice	0.00	0.00	
Dry Snow	0.00	0.00	
Wet Snow	0.00	0.00	
MODTRAN Snow Cover (Fresh)	0.00	0.00	
GENESSIS Fresh Snow (50 um radius) ...	0.00	0.00	
GENESSIS Old Snow (1000 um radius) ...	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
MODTRAN Cloud Deck	0.00	0.00	
Blackbody	0.00	0.00	
Whitebody	0.00	0.00	
Still Air	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Dry grass (Dry meadow fescue grass) ..	0.00	0.00	
MODTRAN Grass	0.00	0.00	
MODTRAN Dead Grass	0.00	0.00	
MODTRAN Burnt Grass	0.00	0.00	
Lawn grass (irrigated crops)	0.00	0.00	
Scrub	0.00	0.00	
Pine Tress (Mixed pine needles)	0.00	0.00	
Broadleaf Trees (Summer)	0.00	0.00	
Broadleaf Trees (Winter)	0.00	0.00	
MODTRAN Forest	0.00	0.00	
MODTRAN Farm	0.00	0.00	
MODTRAN Maple Leaf	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Packed Soil (reddish clay loam)	0.00	0.00	
Beach sand (silica sand/silt loam) ...	0.00	0.00	
Limestone-Silt-Sand	0.00	0.00	
Limestone-Silt	0.00	0.00	
Salt-Silt	0.00	0.00	
Silt-Sand	0.00	0.00	
Limestone rock	0.00	0.00	
Sandstone Rock (Red)	0.00	0.00	
Varnished Sand	0.00	0.00	
Varnished Sandstone	0.00	0.00	
Dry Silt Playa	0.00	0.00	
Wet Silt Playa	0.00	0.00	
Dry Silt-Salt Flats	0.00	0.00	
Wet Silt-Salt Flats	0.00	0.00	
MODTRAN Desert	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Asphalt	0.00	0.00	
Concrete	0.00	0.00	
Building Roof (Galvanized Iron)	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
Undefined	0.00	0.00	
User-defined	0.00	0.00	
User-defined	0.00	0.00	
User-defined	0.00	0.00	